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HUSBANDRY:

VOLUME THE THIRD.

COMPRISING

REPORTS OF SELECT FARMS;

OUTLINES OF FLEMISH HUSBANDRY;

USEFUL AND ORNAMENTAL PLANTING;

ROAD-MAKING;

COTTAGE ECONOMY.

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FARM-REPORTS,

OR

ACCOUNTS OF THE MANAGEMENT

OF

SELECT FARMS.

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NOTICE.

It having been considered that, in addition to the General Treatises on Agriculture and Farming, it would be very beneficial to the readers of the "Farmer's Series" to publish the reports of experienced Agriculturists, in the different districts of England, containing detailed accounts, or journals of the mode of management of particular Farms, the state of Agricultural Concerns, Poor, &c., the Committee have taken steps for the accomplishment of this purpose; and it is intended to publish a series of these Farm Journals sufficient to form a volume, which, when completed, will exhibit a detailed view of the principal Agricultural Systems of England.

In the compilation of this work, the labours and responsibility of the Committee have, of necessity, been confined to the selection of the persons to whom the framing of the Reports was to be confided, and, consequently, the opinions expressed must be entirely considered as those of the Authors of the Reports, and not those of the Committee.

FARM-REPORTS.

1. NORTH HAMPSHIRE;

COMMUNICATED BY HENRY GAWLER, Esq.

"A *system* closely pursued, although it may not in all its parts be the best that could be devised, is attended with innumerable advantages. The conductor of the business, in this case, can never be under any dilemma in his proceedings. The overseers, and even the labourers, know what is to be done, and what they are capable of doing, in ordinary seasons. The force to be employed may be in due proportion to the work which is to be performed, and a reasonable and tolerably accurate estimate may be made of the product. But when no plan is fixed, when directions flow from day to day, the business becomes a mere chaos, frequently shifting, and sometimes at a stand, for want of knowing what to do, or the manner of doing it. Thus is occasioned a waste of time, which is of more importance than is generally imagined.

"Nothing can so effectually obviate the evil, as an established *system*, made known to all who are actors in it, that all may be enabled thereby to do their parts to advantage. This gives ease to the principal conductor of the business, and is more satisfactory to the persons who immediately overlook it, less harassing to the labourers, as well as more beneficial to the employer."—*American Almanac for* 1830—*Washington's Agricultural Notes.*

Introduction.

The general rules and maxims which writers on agriculture have attempted to establish, are found so liable to exceptions in their application, that they are of little service to the generality of farmers, and are founded on a refinement of practice not calculated for persons whose education must necessarily be limited. Many of these works presume the readers to be acquainted with the elements of chemistry, with the component parts of earths, and a variety of subjects which cannot be understood by persons who are, in general, strangers to the technical expressions by which such information must be conveyed. But, even if they were furnished by a competence of instruction for such purpose, it is doubtful whether much benefit would be derived from it. The most experienced farmers confess, that the powers and capacity of a soil for production—the best mode of working it, and extracting the greatest return at the least expense—can only be ascertained by actual trial for a series of years; and that the external appearance of the land, or even of the growing crops, cannot be relied upon as sufficient indications of its value. In general, farms of any extent contain varieties of soil, frequently intermixed with each other so irregularly, that it is impossible to class them in a manner which any theory respecting their distinct qualities would recommend as most advantageous for their management. In one field are often to be found clay, gravel, and chalk, strong and light sands, arranged in patches, which do not admit of any separation for practical purposes; and such fields must receive, in all their parts, nearly an uniform mode of culture, the same number of ploughings, the same quantity of manure, and the same rotation of crops.

From these circumstances it does not appear probable that any great nicety in the practice of agriculture, founded on chemical tests or upon theoretical doctrines, can be generally introduced.

This difficulty is increased by the disposition of labourers upon a farm to

resist all innovation in their usual routine of practice. A change of system requires a corresponding change in their habits, which are quite mechanical, and in the commencement supposes, in those who are to be its instruments, some exertion of thought and attention to which they are unaccustomed. The labourers have no obvious personal interest in the success of any experiment; they foresee no increase of wages, of ease, or comfort; and, without being in any manner worse men than the rest of their species, they remain stationary in their acquirements, because they have no visible or palpable inducement to urge them on to improvement. The habits and practice of the small farmer and peasantry in general, if they be investigated, will be found to originate in indolence of mind and body. They adopt such expedients as require the least thought, attention, and labour, to effect their purpose. A comparison of the effects of this system with the result of a change, and the calculation of the advantages to be derived from increased activity and expense, usually exceeds their powers of comprehension.

For some few years previous to the commencement of the present century, and for many years after it began, corn bore a price, and capital applied in farming produced a profit, which tempted persons of good education to engage in the employment; and its theory and practice were examined with the industry and acuteness which the enlivening prospect of wealth and success is sure to excite. The great causes of this gradual, and then increasing rise in the price of corn, was not at that period generally known. They are now admitted to have been the combined effect of a monopoly of manufactures and commerce enjoyed by this country, a depreciation of the currency, and a vast increase of the public expenditure, the means of which were furnished by loans and taxation; but the landlords for a length of time attributed this change to circumstances which they held to be accidental and occasional, and were not disposed to consider it as a ground for the augmentation of their rents, and many were bound by the terms of leases which had been previously granted.

It was at this period that the press teemed with books on agriculture; and farming was represented, during this brilliant era, as a science with which our ancestors were little acquainted. The rocks of Scotland, and the chalks of England, were presumed to be barren, because we were ignorant in what manner they should be cultivated. The mines of Mexico and Peru have hardly been described in more seducing language; and it was only because the subjects for this picture were too close for inspection to admit of the delusion being complete, that great fortunes were not made at the expense of misguided individuals.

From this dream the people of this country are hardly yet awakened; but farmers in general are fast returning to their occupation as a trade, in which, for the benefit of the country at large, the individuals who are engaged in it must be exposed to a severe competition with each other, be subjected to a rigid economy in the conduct of the details, and to a forbearance and privation which, under ordinary circumstances, is not, perhaps, in a similar degree exacted from other labouring classes. The trade of a farmer rarely affords the means of accumulating a fortune. The eye of a master is required to conduct the details with advantage, and his power of personal inspection must be restricted to a few hundred acres. The produce is limited; no extent of connexion can increase his customers; no skill or activity can augment indefinitely the articles he has to sell.

The science of agriculture has undoubtedly been greatly improved within the last thirty years, in all its departments, and further progress may be made in it. But the impulse it received from high prices no longer exists, and whatever advance is now made will be gradual and slow. It

is probable, however, that the limit of the highest state of cultivation is not so far distant as we may suppose it to be in arts and manufactures in which new combinations of the materials are employed, and new machinery is furnishing constantly greater facilities in operation, and some addition to the former excellence of the articles produced. But in articles which are the produce of agriculture, human science and industry have not the same advantages. Climate and soil are the main instruments by which all vegetation is raised. Man has no control over the first, and much less over the last than is generally supposed. There is in every soil a certain natural power or strength of production, technically termed by the farmer, the staple of the land, which evidently forms the boundary that limits the benefit of attempted improvement. The soil may be combined with ingredients which may render it unhealthy to vegetation, and manures and cultivation may neutralize or destroy their effect. Where such ingredients do not exist, manures may stimulate the land to act upon the crops to a degree it would not have done without their application; but experience teaches beyond all doubt, that working and manures may be applied to an extent that may be injurious, and when they are employed beyond the measure which the state and strength of the land require, the crops of corn are not increased in quantity, and do not improve in quality. The observation is peculiarly true as to the thin light soils of the district hereinafter described, which lie upon beds of coarse calcareous rubble—the stratum interposed between the surface soil and the chalk. The depth of ploughing in them is necessarily confined, and new soil cannot be gradually turned up and incorporated with that which was previously cultivated.

It requires caution in recommending new experiments to farmers; they should try them upon a small scale, unless they have succeeded in circumstances similar to those under which they are proposed to be introduced. The practice of every district is followed by successive generations, without any investigation as to its causes and merits, but in general, the outline and main body of the system which has been adopted, originates in the nature of the soil, and in local circumstances. It admits of little change, except in its better execution, in the improvement of machinery, in the breeding of stock, and treatment of their diseases, and in a more convevient distribution of the fields and farm-buildings.

The instruction adapted for the state of information and habits of the generality of farmers, will be best conveyed by detailing the management of a farm comprising land of various qualities, but where none is much above or below a medium between the best and the worst, and where the management is carried on by the usual system of broad-cast sowing—without any very peculiar selection or refinement in the implements and machinery.

DESCRIPTION OF THE FARM.

On a farm situate in the north of Hampshire, consisting of about two hundred and thirty acres, the writer, assisted by a bailiff, has succeeded in deriving a net average profit from its produce, much more considerable than any rent he could have obtained from a tenant, and has had, besides, the advantage of keeping the property in a state of neatness, the fences in a state of repair, and the land in progressive improvement, uninjured by exhaustion—benefits which, probably, are not to be derived, or expected, from any hands but those of a proprietor.

The land of this farm contains three sorts of soil:—

1st. Clay of a very binding nature, mixed with gravel;

2d. Gravel mixed in many places with a much less quantity of clay than

the former contains, and occasionally a proportion of darkish mould, probably the produce of decayed vegetable matter;

3d. A light-coloured soil of a loose texture, from four to seven inches deep, covering the rubble which lies on the top of the bed of chalk, the substratum on which the whole land of this country ultimately rests.

The farm consists of nearly equal quantities of each soil, sometimes distinctly separated from each other to a considerable extent, but often so intermixed that no division for any practical purpose can be effected. Whenever such division is practicable, it has been made, as undoubtedly each quality of soil requires a different rotation of crops, and different quantities, and, if they can be had, different qualities of manure.

The general aspect of the farm inclines to the south, but about sixty acres are exposed to the east and north. The whole is comprised in one fence, and is intersected and bounded by good roads.

The buildings are inconveniently disposed. They lie at one end of the farm—a situation, for obvious reasons, most objectionable.

There is no town in the neighbourhood from which any considerable supply of manure can be procured; and the little that can be obtained is purchased at an expense which is hardly compensated by the increase of produce, with the exception of wood, coal, and peat ashes. The two first are collected from the houses and cottages, and the latter is brought, by means of a canal, from more distant parts.

Manure, therefore, can only be obtained from the common and usual sources of the folding of sheep, the stable, and the farm-yard, with such occasional addition of mould and decayed vegetable matter as can be collected on all farms.

Use of Chalk.—The surface-soil of this part of the country rests upon a bed of chalk, which frequently in spots is found to be of a soft and unctuous nature, and crumbles into very small fragments and powder by the effects of rain and frost. Whenever the chalk can be obtained with these qualities, it contributes essentially to subdue the tenacity of the hard and compact clay, and to render it more ductile and yielding to the operations of the plough and harrow. When this chalk has been laid on the gravel, mixed with but little clay, it has been found eminently useful, by its quality of retaining moisture, and perhaps by chemical changes it may produce upon some ingredients contained in the soil which are unfavourable to vegetation. It is applied in a quantity sufficient to afford a covering of an inch or an inch and a half in thickness, and permitted to remain exposed until it is well pulverized by the effects of frost and rain. This sort of chalk has generally been selected, and carried in carts from the pit from which it has been dug during the hard frosts, when there is little other occupation for the men and horses, or in summer, when the land can bear the pressure of the loads. The common practice of digging pits upon the spot intended to be chalked, is objectionable; it defaces the surface of the ground by leaving permanent holes in places from which it was extracted, and, being thus taken without selection as to its quality, is frequently much less adapted to the purpose it is intended to answer.

The effect of laying this chalk upon the second sort of land, in which the gravel is intermixed with the small portion of clay, has been most remarkable, and in every instance where it has been tried, uniformly most beneficial. Previously to the application of the chalk, this part of the farm, although manured, folded abundantly, and trod well by sheep, to condense the soil, was extremely precarious in its produce, and the expense and care bestowed upon it were rarely compensated by a corresponding return. The wheat grew freely at first, and continued to bear a very favourable appear-

ance until the spring, when the ground assumed a spongy, hollow texture, the plant acquired a dark brownish hue, died in considerable quantities, and the remainder produced at harvest from twelve to sixteen bushels per acre of light corn, with the straw invariably stunted and blighted. From the time the land was chalked in the manner I have before described, these unfavourable tendeucies of the soil were corrected. The same land now produces from twenty-four to thirty bushels, of excellent quality; and in no instance has any recurrence of its former unhealthy condition been observed. The mischief was not confined to the wheat crop: the barley, oats, tares, and clover, suffered in the same proportion, and have equally derived benefit from the chalking.

The value of chalk, for the purposes I have mentioned, does not extend, on this farm, beyond the first and second qualities of land, the hard compact gravelly clay, and the gravel with the less proportion of clay: when applied to the third quality of soil, the light-coloured loam, its effects appeared to be injurious; probably this soil was already sufficiently mixed with it, which rendered the addition, if not detrimental, at least useless.

ROTATION OF CROPS.

The best soil on this farm is the compact gravelly clay. It is cultivated (except the course be interrupted by very unfavourable seasons) by the rotation of crops generally adopted by the best farmers in this part of the country:—1st, wheat; 2nd, turnips; 3rd, barley; 4th, clover and rye-grass. Occasionally, after two or three wet seasons, instead of sowing wheat on the clover lay, the land has been permitted to lie fallow the ensuing summer, has received three good ploughings, and the earth been well pulverized by repeated harrowing and rolling. The practice of fallowing lands of any quality has been objected to by many eminent agriculturists as unnecessary, and as not conferring any benefit proportioned to the loss of one season. It is a question which can be resolved only by the experience of a considerable length of time, aud the calculation of the loss or profit cannot be very satisfactorily made. But the system, as applied to this sort of land upon the occasions to which I have referred, has certainly improved the succeeding crop, especially in its quality.

I. *Wheat.*—The wheat generally sown on the best land, and on that which is in high condition, are the white sorts; and of these sorts, the preference has been given to the velvet-husked. This wheat, when it enjoys the advantage of being sown on land in high eondition, is equally productive with the brown, and sells from thirty to forty shillings per load higher. The straw is usually short, compared with that of other sorts, and therefore less liable to be beaten down in stormy seasons; and the fur upon the husk appears to afford considerable protection against the blight or mildew, one of the destructive scourges of our climate. This wheat should be cut as soon as the internal part of the grain is set, and when upon pressure it is found the milky fluid is absorbed. It will ripen quickly as it stands in the shock. When thus cut, the sample is always brighter, and clearer, and weighs heavier, than when it is suffered to remain longer in the ground. When the harvest is late, and those obvious causes of blight, the warm drizzling rains and morning fogs, are to be expected, the hazard of exposure to this mischief is diminished: a week is often of importance at this critical period; and by being in advance upon the general commencement of the harvest, labourers are more easily obtained, and the wheat secured by means of additional hands, which cannot afterwards be obtained.

On the second and third qualities of soil, this white wheat does not on an average succeed well. In favourable seasons, and when these portions

of the soil have been in high condition, it has produced an ample return; but in the event of a dry, or very cold and wet summer, the crop, compared with that of the brown wheat, planted under the same circumstances, has been deficient, the ear imperfectly filled, and the grain meagre. The red-straw Lammas has been found the best adapted, on an average of years, to the two last qualities of soil. It appears to resist better the bad effects of unfavourable seasons; and, from the depth of its colour, it disguises better any injury it may have sustained.

Sowing.—From three to four bushels of wheat and from five to six bushels of barley, are sown to an acre. The wheat crop, upon an average of a number of years, has yielded twenty-six bushels per acre;—the barley crop, eight sacks per acre. In the most favourable seasons, the average of the wheat has been rather more than thirty-six bushels per acre, and in the worst seasons, when wet and cold prevailed, as in 1828, seventeen bushels per acre.

Period of Sowing.—In many parts of this district, upon very light land, the wheat is sown, if the season permits, as early as the end of August; but upon the farm now described, none is sown earlier than the last week in September, nor later, if it can be avoided, than the middle of November. If sown earlier than the first-mentioned period, it grows rank, and mats together in warm and long-protracted autumns, and in this state it suffers from a succeeding alternation of frost and wet; if sown later than the last-mentioned period, especially on the second and third qualities of soil, it hardly shoots its roots to a sufficient depth to prevent them from being loosened, or partially exposed, and often, in considerable quantities, thrown entirely on the surface, by the swelling of the ground in frosty weather.

Tares.—The ground from which the wheat has been reaped is ploughed as soon after harvest as other works, indispensably necessary, will permit. A portion of it is sown with winter-tares, the latter end of September. This crop is of great value, if it be not injured; but it is so liable to be thinned by the alternation of warm days, and cold winds, and frosty nights in spring, that it cannot be relied on as a certain resource for stock. For this reason, the larger portion of land intended for tares is sown in February, March, and April, with the sort called the spring-tares, mixed with a bushel of oats to an acre. They are evidently a different plant from the winter-tares, the leaf which first expands is different, the seed is larger, it grows with more luxuriance, and produces, in general, a heavier crop. Within these few years, a variety of the spring tare has been imported, probably from Holland, and sold in our markets under no fixed name. This seed is small, like the winter tare, and springs up with a similar leaf; but it throws out more numerous branches, and has a coarse and hardy appearance. The stem is shorter, and it preserves an erect position longer than the varieties in common use. It succeeded well on the second quality of land.

Tares afford a main supply of food for stock in the month of June, and part of July. If the crops be luxuriant, and the season wet, they should be cut with a scythe, and put into cages for the sheep. If, under such circumstances, this plan be not adopted, a third of the crop will be wasted.

The experiment of making tares into hay has been tried on this farm, but it cannot be recommended as a general practice. Wet is very injurious to them during the process, and, when made in the best seasons, they are by no means a favourite food with cattle. The sheep feed upon them in this state with reluctance.

II. *Turnips.*—The remainder of the ground from which the wheat crop was taken, is sown in the spring, and during the succeeding summer, with turnips, of which a very considerable portion are Swedes; the residue are

the tankard, the globe, and, towards the autumn, the green rounds. The Swedes, except in very unfavourable seasons, succeed well on the first and second qualities of soil; but on the third quality of soil, they rarely swell, and grow with the freedom which renders the interior of the bulb firm and mellow. They increase slowly on this last soil; the rind is thick, the external flesh is tough and fibrous, and betrays the same appearance of want of proper nourishment which all esculent vegetables exhibit, when planted in soils which are defective in fertility, or not congenial with the nature of the plant.

Drill Husbandry.—The system of drilling turnips has been tried on these soils, but the result has not been encouraging, and upon an average of years the broad-cast sown have the advantage. Two methods were followed—the one by depositing rotten manure in a furrow, covering it again with earth, and drilling the seed on the ridge—the common practice of the North: the other by drilling them in rows at two feet distance, when the ground was levelled and prepared as for broad-cast sowing. But both methods, on the first and second qualities of soil, are liable to nearly the same difficulties and objections. Notwithstanding all attempts to subdue wholly the tenacity of the hard gravelly clay by the means of chalking, it breaks up under the plough and horse-hoe, in dry or very wet weather, in large clods or masses, which frequently bury the plants when small, or leave their roots exposed to the air. The resistance of the compact clay and stones in the first quality of soil, and of the stones in the second quality, disturbs both instruments in their operation to a degree sufficient to make it hazardous to approach very near the rows, and the plant loses the benefit of having the earth loosened about it—a process which tends so essentially to promote its growth. In a district, also, where the drill system is not generally adopted, the labourer who thins the plants with the hand-hoe interposes his objections. He finds plants in rows more difficult to thin than the broad-cast: it requires a change in his mechanical exertion of limbs.

The advantage mainly derived from the drilling Swedes on ground levelled as for broad-cast sowing, consists in the means the sytem affords of covering them, before the approach of winter, with mould by the assistance of a small plough. This was usually effected in the middle of November, in time to prevent the rooks, larks, wood-pigeons, and game, from attacking them when their other accustomed food begins to fail. The larks, and perhaps other small birds, bore small deep holes, in which the water settles and rots the heart of the plant. Hares consume a portion of the bulb, but the remainder often continues sound. The Swedes are by this method preserved fresh and uninjured. They did not appear to suffer in any respect from the covering, and in the spring the rows are turned out by a plough as they are wanted for use. Upon land which permits the drilling of Swedes to be practised with advantage, this mode of preserving the bulb may be safely recommended. It probably has been adopted by other farmers occasionally; but examples of this plan, it is believed, rarely occur.

It is the common custom to permit the Swedes to sprout out in the spring for the feed of the lambs, but the bulb is thus materially injured. Each shoot supplies its growth by a mass of roots which strike into the bulb, and fill it with hard fibres. Its juices are drained, and it becomes impenetrable to the tender teeth of lambs, and is only destructible at the expense of the stronger teeth of the ewes.

As soon as the shoot has begun to spring with any luxuriance, the method has sometimes been adopted of pulling up the bulb, and leaving them spread about the ground for the use of the stock. In this state they be-

come mellow, but remain firm and juicy often until the end of May, and beginning of June. When the season arrives for sowing with barley the ground on which they had grown, they were removed in carts to some grass lay, and there again spread out for the sheep.

After many years' experience, no crop has been found more useful on this farm than Swedes, and none which, on an average, affords a more secure and certain resource for stock. They are the favourite food of sheep, horses, cows, and pigs; by care they can be preserved far in the summer; and it is hoped it will not be thought disrespectful to the human species, when it is added that the Swedes compose a considerable part of the nutriment, from predilection and choice, of the young labourers, the boys who work upon the farm. They appear to agree well with the constitutions of persons blessed with such powerful and healthy digestion.

The other turnips are sown broad-cast, and managed in the usual method.

The Period of Sowing.—The value of all systems of farming must be determined by their effect on an average of a number of years. In some seasons it answers well to sow the turnips early; the Swedes as early as March, and the beginning of April, and the other turnips in April and May; but in this part of the country, the practice is not to be recommended as a system. During the cold weather of the early months, the plant springs and grows slowly; it assumes a stunted appearance, its tender leaves are long exposed to insects; a thickness at the top of the root, partaking of a premature disposition to form a bulb, accompanied by a wrinkled rind, indicates a state of disease, from which no favourable circumstances will afterwards wholly recover it.

Towards the middle of June, the air and earth have been considerably warmed; the plant then springs and grows quick, escapes soon through its tender stages, and will generally produce a more abundant crop, and of far better quality, than when it has been crippled and stunted by unfavourable weather in the earlier season.

The turnips, in general, are consumed by the sheep on the ground upon which they grow. No inclemency of weather prevents this practice on the second and third qualities of land, and it is then beneficial by the treading and consequent condensing of the soil: on the first quality of land in a very wet season of long continuance, and when the ground is soaked with moisture, this practice may be injurious. In such cases, the land is rendered too tenacious by the pressure of the stock, and the health of the sheep might be impaired by lying on ground so saturated with water. They are then removed to a drier spot. But such instances rarely occur. The whole of the farm slopes to different aspects, and a continued drainage is thus effected, which assists materially the absorption by the earth, which is, in some degree, always taking place.

The whole farm may therefore be considered as a good turnip soil—a valuable quality in ground of medium worth. Upon such soils the turnip is the great instrument of improvement. No crop upon a given surface of such ground affords so abundant a bulk of food for sheep, and none contributes to produce more manure. The lighter lands are condensed by the treading of the stock, the stronger are in moderate weather kneaded into a consistence very favourable to wheat, and the ground is cleaned by the frequent hoeings which are indispensably necesssry to promote the growth of the plant. Since the introduction of the turnip, in considerable quantities, in agriculture above a century ago, its use has been progressively extending, and has laid the foundation, on the lighter soils, of the excellent cultivation which now prevails. Fifty years ago this plant was little known

in the district where the farm now described is situated. Within that period the crops are doubled. The stock of sheep on the same quantity of land is doubled, and their health is less precarious. Turnips afford a change of food; and for such change all animals hava a strong desire; they are a resource of great importance when the hay is injured by wet seasons; and as wet seasons are favourable to turnips, it is a resource which rarely fails.

The common turnip continues to be a wholesome and nutritious food until the very cold weather commences, towards the end of November, by which time either the nature of the turnip or the powers of digestion in the sheep appear to be affected; and so prejudicial upon this farm are they esteemed to be, at this season, to ewes heavy in lamb, by creating wind and inflating the stomach and bowels, that the quantity given is very cautiously allotted. The best corrective is an allowance of hay, which is often too long delayed from mistaken motives of economy. The ewes suffer frequently materially from this neglect, and the strength and health of tha whole stock are impaired. It has been thought, that by an allowance of a portion of Swedes, together with the common turnip, the hay might be omitted with less danger. The Swedes, though ranked usually under the common term of turnip, are a distinct species of plants, in which the elements which constitute nutriment exist in much greater abundance. Upon this farm, from these motives, the use of Swedes often commences early in the autumn. They are scarcely ripe until the middle of November, and continue to grow and swell until that period. But in their imperfect state, they supply far more nourishment than the common turnip, and prepare the stock for sale at the fairs in October and November in a manner not easily accomplished without their assistance.

III. *Barley.*—The barley-crop is sown after the turnips. The land requires more or less ploughing, according to the quality of the soil, and the state in which it is found, after the season for the working of it commences. The compact, gravelly clay, if the turnips have been fed off during wet weather, breaks up in large clods, and requires to be reduced by the roller; and at least a second ploughing given before the barley can be safely sown; and if clover be sown with it, it renders this process indispensable. On the second and third qualities of land, one ploughing is quite sufficient. The sowing commences early in March, and continues until May, by which period the Swedes bave been removed from the turnip land, if any remain, to some grass-lay. The time of sowing, when on compact, gravelly clay, must, in some measure, depend on the season. It cannot be worked in very rainy weather. If any very hard storms of rain succeed the sowing, the surface runs together so closely, that the air is prevented having access to the seed, and its vegetation is obstructed.

The two other qualities of soil are not exposed to this disadvantage.

It is customary in many counties, on light soils, to sow barley in the month of February. This practice is followed by many farmers in this district.

In barley sowing, as in sowing all other crops, it is always to be considered what system succeeds the best, upon an average of several years; and beyond a dispute, upon an average of years, the early sown barley produces the largest crops, and the finest grain. Until the end of March, the sowing may be considered to be early; and it is from the sowing made during that month, that the best barley on this farm has been obtained.

The plant which springs from the February sowing is apt to be injured by the frosty nights in March. Upon the compact clay, it turns yellow

from this cause, and rarely afterwards grows with the same luxuriance and vigour, as the plant which has escaped this danger.

The barley grown on the compact clay is of a coarser quality than that which is produced from the soils of the second and third qualities, but the crop is more abundant, and thus in some measure compensates for the inferiority. That which is produced on the light chalk soils of this district is well calculated for malting; the skin is thin, and its colour rich, but light; but it never equals, in fulness of meal and plumpness of appearance, the barleys grown in Staffordshire, and on loamy lands.

The barley of this district is of one sort; it is pretended there are some varieties to be found, which are more productive than that in common use, but the difference between them is not easily detected. It is not unusual to apply some new name to a sample brought into the market, and to represent it as being favoured by some especial quality. Such expedients raise its price for the season, and the imposition is sometimes successful to that extent.

IV. *Grass.*—The grass crop succeeds the barley, and consists, generally, of the common red-clover and rye-grass mixed, or of sainfoin.

The first quality of soil is that on which the clover is most productive; but on all of them this crop is uncertain. An alternation of wet and frosty weather during the winter frequently destroys a considerable portion of the plants; and a dry and cold spring impairs their strength to such a degree that no favourable weather will afterwards restore their vigour.

Rye-Grass.—Under these circumstances, the rye-grass often constitutes the main bulk of the crop when the field is mown. It is much more hardy than the clover, and contributes to shelter and protect its companion. With all these disadvantages, however, no substitute has been found to supply the place of clover, and it continues to hold its station steadily in the rotation of crops. A portion of it is generally fed off by the lambs and ewes, and the remainder is cut for hay as soon as the rye-grass blooms. Farmers in this district are sometimes tempted to leave it standing, in hopes of rain and increasing growth, to a period rather later; but the augmentation of bulk during so short a period cannot compensate for the loss sustained in the succulence and tenderness of the stalk. In a very short time after the appearance of the bloom, the stem of the rye-grass becomes fibrous, hard, and dry, loses in weight, and is far less acceptable to cattle, and less nutritious. The same observation applies to the clover; but in clover, the process towards maturity is not so rapid; its succulence is not so soon exhausted, and more delay can be allowed. On this farm, however, the moment the rye-grass forms its bloom, cutting is commenced, unless the weather should be wholly unfavourable; and experience has confirmed this system, upon an average of years, to be the most advantageous. This crop forms a considerable portion of winter store for the feed of sheep, and when it happens to prove very deficient, exposes the farmer on these soils to difficulties, and sometimes compels him to send a portion of his stock during several months, from November to April, to districts where richer soils produce more abundant crops. Such lands are found in Wiltshire, within the distance of twenty or twenty-five miles, and sheep are usually kept well upon them, at an expense varying from six shillings to eight shillings per head, for the season.

Sainfoin.—All the soils upon this farm are well-suited to sainfoin, but it certainly grows with more luxuriance on the compact, gravelly clay, of the depth of ten or twelve inches, lying in contact with the substratum of chalk. The sainfoin will not flourish on deep clays which hold much moisture, and which are not drained by some sub-soil of a less retentive nature; but on

the shallow clays, resting on chalk, or limestone, it is very productive. On such soil it grows with a stem and leaf more rank and coarse, than on the second and third qualities of land; but the hay made from it is better calculated for horses than for sheep.

The sainfoin is the most valuable artificial grass this district possesses. The dryest seasons rarely essentially injure the crop; the most wet appear only to increase its luxuriance of growth, and thus, under all circumstances, it may be depended on, if it can be converted into hay, as a certain resource for a farm. No food is more grateful to sheep; and the horses, if liberally fed with it, are kept in good working condition without corn. It remains longer in the stack uninjured, than clover and rye-grass hay, which is generally less condensed; it is penetrated by wind and heat with less facility, and a less portion of its nutritious qualities is carried off. Sainfoin hay, when stacked in good condition, is equally good in the third year.

The sainfoin should be cut as soon as the main bulk of the flowers are ready to open; when cut in this state, and made into hay, it weighs more, lies much closer in the stack, and is far more nutritious than when permitted to remain till some of the flowers have expanded, and begin to fade. The loss in apparent quantity is amply compensated by the better quality of the hay.

The plant of sainfoin does not till after the second year arrive at its full vigour and strength, and therefore it is usually, in this district, sown intermixed with the hop-clover, to make up the crop; but it is doubted whether this practice is beneficial. The sainfoin plant is evidently weakened and stunted by the overpowering growth of the clover, which arrives at maturity in its second year; and it is questionable whether the sainfoin ever recovers the injury it thus sustains. As the sainfoin is intended to remain for five, or perhaps six years, and is to be considered as the main object of attention, an injury which spreads its effects over three or four years, by a diminution in the crops during that period, cannot be compensated by the supposed addition of a third, or a fourth, to the crop of the second year. In all cases on this farm where the experiment has been tried of sowing the sainfoin alone with the barley, the plants have invariably been more healthy, stronger, and more numerous, than when mixed with the hop-clover.

The sainfoin plant is generally permitted to remain five or six years from the time of its sowing; but this period is often too long. The propriety of leaving it for more or less time must depend on the quality of the soil,—on its being in high or poor condition, clean or foul; on the compact, gravelly clay, it would last the longest, as being the best soil; but other grasses, the natural produce of such soils, spring up, and in the fourth year begin to form a close tissue or mat about the top of the sainfoin root, which evidently obstructs its free growth, and smothers and destroys a large portion of the weaker plants. On the land of the second and third qualities, the grasses natural to the soil rise less abundantly, and the sainfoin suffers less from their contiguity; but the sainfoin plant itself on these second soils is sooner exhausted, and becomes less productive.

It is doubtful whether a sainfoin lay should not, at all events, be broken up at the end of the fifth year; and in most cases, at the end of the fourth; and this system has been generally adopted on this farm.

In this district, the main difficulty attending sainfoin arises from the necessity of sowing it on a soil on which it has not been planted for at least eight or nine years. All plants used in agriculture evidently benefit by

permitting considerable periods of time to intervene between their course of sowing; but in many sorts, as in wheat, and barley, or oats, manure will restore, in a great degree, those ingredients in the soil, which former crops of the same grain may have exhausted; but no species of manure has yet been found in this district to supply that particular nutriment which sainfoin demands, and of which its growth has deprived the soil; and the land must be permitted to acquire gradually those aliments, whatever they may be, which constitute the food of this plant.

The clover, in some measure, in this respect, partakes of the nature of the sainfoin in this district. It is generally the crop of every fourth year; but the best farmers admit, that even this interval is not sufficiently long to obtain a crop proportionally abundant with those of the intervening grain; and that the highest state of cultivation, in as far as it depends on manure, will not supply the defect of longer intervals between the sowings. They are compelled by necessity alone to follow their present system, as no substitute has been as yet suggested, which is consistent with the rotation of other crops.

The best crops of sainfoin in this district do not exceed two tons and a half per acre, and probably upon an average of a number of years, no farm produces more than a ton and a half, or between that quantity and two tons per acre.

It is difficult to conceive by what means any considerable stock of sheep could have been kept here, previously to the introduction of turnips and sainfoin into common use, both of which were little known a century ago. This country consisted, at that period, of large tracts of down, now broken up, which afforded a subsistence for the flocks in summer; but in the winter, they must necessarily have resorted to the richer pastures of other districts, where the natural grasses afforded a sufficient growth to make hay.

MEADOW-LAND.

The natural meadow ground in this district bears a very small proportion to the arable, and hardly enters into the account of a system in the distribution of a farm. Upon the farm now described, about fourteen acres of gravel, mixed with dark loose mould, were highly manured and well cleaned, and laid down twenty years since with varieties of grass seeds in great abundance, collected from the growers near London, and of the sorts which, according to the doctrines then prevalent, were held to be best adapted to the soil. They flourished for four or five years, and promised to form a permanent meadow, but they gradually disappeared, in defiance of the utmost care and attention bestowed on their management, and were superseded by, or acquired the appearance of, the short and wiry grasses, the indigenous growth of the soil, and formed a turf resembling an ancient down. The feed is at all times wholesome; but, except in very wet summers, not abundant. It disposes the cattle to increase in flesh more than in milk. This portion of the land was chosen for this purpose, from its contiguity to the house; but the other qualities of soil have not been found much better calculated for this purpose, and no attempt to fix the finer meadow grasses in them permanently, has succeeded.

None of the soil upon this farm is well suited to potatoes. Upon the third sort of land their quality is excellent, but the crop is never abundant, and cannot be cultivated for profit. An acre is however always planted for the use of the family and the carters and men who reside at the cottages contiguous to the house.

STOCK.

The stock in general best adapted to this land are, the Alderney, and smaller race of Norman cows. The Devonshire and larger breeds require richer pasture; and although they are kept in condition, the milk they give is by no means in proportion to the bulk of food they consume. The Norman and Alderney cattle appear to be less affected by the quality of the herbage. It has been customary on this farm to keep one cow of the Devonshire breed, with three nf the Norman or Alderney, and to mix the milk, on the presumption, that by being thus diluted, it produces better and a larger quantity of butter. The cream is skimmed, and scalded over a stove, before it is churned. This process certainly renders less churning necessary, gives the butter more flavour, and increases the quantity. In a district where meadow land is scarce, butter generally bears a high price, and perhaps no part of the farm described is so profitable as the small portion of it allotted to the dairy.

Sheep.—The sheep kept on this farm are usually called South Downs; but they are not the pure race, they are larger, and weigh, when in the usual condition for the butcher, from 60lbs. to 70lbs., and sometimes more. They are extremely docile and manageable, and are perhaps better calculated by their weight to knead and condense the soil than those of a lighter description. Their fleece averages about 3¼lbs. for each sheep; the wool is short and varies considerably in fineness according to the keep. Where their food consists of artificial grasses and turnips, the wool is much coarser than of those which are pastured principally on Down lands, and have to work harder for a subsistence. The practice of folding is indispensably necessary to farming in this district, and no system has been suggested which can supply its place. The wool is, however, probably injured by the continual exposure to the alternation of wet and severe frost during the winter, and it certainly bears no comparison in colour, fineness, softness, and beauty, to that shorn from flocks which are sheltered and housed during inclement weather.

Lambs.—It is the common practice here to expose the ewes during the season of lambing in folds in the open fields, without protection from the fall of rain or snow. This is the consequence of the habitual thoughtlessness of the farmers, who, being accustomed from early education to spare all the labour and trouble that absolute necessity does not enforce, neglect the precautions which more vigilance would suggest. The loss of lambs, upon an average, amounts to near one-fifth of the whole. Common sense would appear to indicate the prudence of affording a dry spot on which such tender creatures as new-born lambs may be deposited until they have gained snme strength. The ewes suffer at this period nearly as much, and are often attacked by fevers, which affect their milk and destroy its wholesome and nutritious quality. A fold, under these circumstances, in wet weather, exhibits as dreary and dismal a spectacle as can well be imagined, the lambs trembling with cold, and the maternal affections of the ewes half extinguished by their own suffering. The system is justified by the farmers, on the ground that it renders the flock hardy; but the truth is, that none but the strong survive the treatment, and probably their constitutions are injured by it.

The sheep with black faces are the favourites of the farmers; but it seems a doubtful test of their merit, whatever it may be as to their beauty. About fifty or sixty years past, a sort of sheep called the Wiltshire, of greater size than the largest Dorset and Somersetshire sheep, with much more bone, and longer legs, constituted the flocks of this country. They were enabled from their strength and length of limb to ramble over

the extensive downs which have since been broken up. The increase of arable land has banished this ugly race; some specimens, however, even now occasionally appear at fairs, which frighten the delicacy of modern farmers, accustomed to better models.

Pigs.—The common run of pigs in this district are by no means remarkable for their beauty. They are generally of a light colour, marked with large black or red spots, or in large divisions of black and white. They are of a hardy, enduring, and active nature; draw their subsistence from all materials they can swallow, and are managed, in general, with slovenly inattention. However, considerable exceptions must be made. The breed is sometimes crossed by the Essex, Chinese, or Neapolitan race, or the pure breeds of these sorts are introduced; but in some few generations, accident or design produces an intermixture, which, after a few more generations, terminates in a recurrence to the common race of the country. Upon the farm described, the event has repeatedly happened, and it is believed that, considering the different qualities of each sort, the merits and defects of the varieties are nearly balanced.

Some varieties of pigs evidently fatten more rapidly and upon a less quantity of food than others; this was found to be the case with the black breed from Essex, but the sort was tender, and were not so equal to the fatigue of attending their duty in the stubbles, and appeared to be very sensible to the effect of cold.

Management.—It is a common opinion in this district, that pigs are not a profitable stock upon a farm, in a quantity beyond that which is necessary for the consumption of the offal produce which cannot be carried to market. This opinion may reasonably be doubted; and certainly upon the farm described, where they are kept to a larger extent than the usual proportion to the size of the farm, they indisputably give an ample return of profit. A quantity of Swedes is usually reserved for their use. The Swedes are a favourite food with them, and apparently they prosper upon them more than upon any other food which is not the produce of grain or pulse.

In fattening of pigs, an opinion is also entertained, which springs from indolence and thoughtlessness. It is held that changing the litter, and cleaning the sties, protract the time of the animal's arriving at his required fatness, and that filth contributes more to his health and prosperity than cleanliness. This opinion is not the result of experience, for very few persons here have tried the alternative of cleanliness; but it is a theory they have derived from their progenitors, in which they will persist if they be permitted. No analogy of reasoning as to the effects of filth on other animals shakes their belief, and the practice can only be overcome by the determined authority of a master.

ESTABLISHMENT.

The farm described is worked by a bailiff, a head carter, and an under carter, a shepherd, two boys, and two labourers, in constant pay, and seven horses. Except during the hay and hoeing seasons, weeding and harvest, further assistance is seldom required.

The size of the farm described is by no means recommended as a model. The extent of it was unavoidably thus circumscribed. Neither the bailiff nor shepherd has full employment; the bailiff might superintend one hundred and fifty or two hundred acres more, and the shepherd might equally well manage three hundred and fifty sheep. A farm, however, from three hundred to three hundred and fifty acres of arable land, affords ample business for a bailiff, who engages in any portion of the working

duties, keeps the men and horses in full activity, and makes the most of their strength. It is as much as his eye and attention can command, if he overlooks all the various proceedings, and by foresight and diligence guards against the casualties which are apt so often to occur from the negligence and careless habits of the individuals who are employed as carters and labourers.

Horses.—The horses selected for the service of this farm rather are of fine bone, above fifteen hands high, with strength quite sufficient for the team and plough, but which move with a quicker step than those with large heavy feet, hairy fetlocks and thick legs, a species however in very common use. The former are also less subject to disorders than the latter. Carters frequently take a considerable interest in the beauty and good looks of the cattle under their management, and from these motives bestow more care upon horses which attract their attention. It requires very superior merit in a vulgar coarse-made horse to become a favourite, or even to obtain for it a just share of dressing and food. Beauty in all animals always engages even the most common minds in its favour, and generally it implies some useful corporal quality. The carter's regard for his cattle is purchased cheaply, at the additional expense of a few pounds per head for a horse. Every person the least conversant with farming is aware how completely the horses are at the mercy of the persons who drive, feed, and dress them. It is advisable to consult and indulge their wishes and prejudices, if they lead to no essential mischief: their predilections are sometimes harmless, and it is frequently difficult to subdue or counteract them.

IMPLEMENTS.

Ploughs.—The ploughs of this district are constructed, with the exception of the handles and beam, entirely of iron, and are much reduced in their length and dimensions from those which were employed thirty years ago: they are generally worked by three horses. The binding nature of the soil renders this force so often necessary, that the habit of driving with reins has not become general. So powerful is the effect of custom, that some farmers are yet seen working a soil of four or five inches deep, with four horses dragging the ploughs of the ancient form and unwieldy construction, at a slower pace than with three horses and the modern instrument.

Threshing.—The wheat is threshed on this farm by a machine, and the quickest moving horses are selected for the work; they do more work and do it better. A rapidity of motion is favourable to the threshing the corn clean. Sometimes half-bred horses with a good deal of bone have been employed on this farm; they are difficult to procure at a moderate price, but in the threshing-machine, harrowing, and rolling, they are unrivalled.

The barley is thrashed with a flail. The machine is apt to strip it off, and does not therefore bring it out in a state so fit for the market. The two labourers can also be generally sufficiently spared from other work for this employment.

The threshing-machine is, of course, a very unpopular instrument, and to the use of it, amongst other supposed abuses, the present comfortless situation of the peasants is often attributed. The train of reasoning by which it can be proved that whatever machine saves expense or labour to the farmer must ultimately lower the price of the commodity it assists in preparing for the market, is not calculated to satisfy the labourer. His mind always recurs to the single point of the lost use of the flail. This aversion to the machine has indisputably had the effect of reducing their number, and still more the use of such as exist.

MANURE.

Different opinions exist respecting the state in which stable and farm-yard manure should be applied; whether it should be carried out fresh, or be permitted to ferment and be decomposed. It is almost impossible to doubt that if an immediate effect be the object, it is better calculated, in a rotten state, to afford nourishment to the plant; but if a permanent benefit to the soil, to a succession of crops, and the amelioration of the greatest extent of land be intended, it is better to apply it as fresh as possible.

By suffering dung to ferment, a great portion of its valuable ingredients are carried off by evaporation, and it becomes much diminished in bulk and weight. The business of a farm does not at all times permit the conveyance of it to the fields for which it is allotted, and a part is thus unavoidably exposed to fermentation, but this process may be retarded by frequent turning and by mixing considerable quantities of mould with it. Mould should always be placed at the bottom of a dung heap, and, if possible, the heap should be covered with it. The moisture is constantly draining downwards, or passing off in the shape of gas or steam from the top. The covering at the top and bed underneath intercept materially this loss. On this farm, the manure during the spring, autumn, and summer, is carried out as fresh as possible. In the winter it is spread in the sheep fold, to protect the stock from the dampness and cold of the ground. If the dung cannot be ploughed in during the warmer seasons, or conveniently mixed with mould, it remains in the yard where it is better protected from the drying effects of the heat and wind than in the field. The plough follows the fold course as quickly as possible.

Sheep.—The common allowance, in this district, for the number of sheep on a farm, is said to be one to each acre, but perhaps few farmers within it upon an average feed near that quantity throughout the year. On the farm described, about two hundred and thirty sheep are constantly fed on two hundred acres of the land, besides the lambs which fall in February, a portion of which are sold in the October following, together with some ewes which are drafted from the stock. Some sacrifices are made for this purpose; a less breadth of corn than the usual proportion is sown. It has happened three or four times in the course of twenty years, when both hay crops and turnips have failed to a considerable extent, so that about fifty lambs have been sent to winter in other places. By this plan of allotting more land than the usual proportion to stock, the arable is kept in higher condition, and the plant on it is enabled by its vigour to resist the mischief to which, in unfavourable seasons, if it were in a weaker state, it would be exposed. The farmers in general are desirous to sow a certain proportion of each sort of corn, without sufficiently referring to the condition of the land. No practice can be more injudicious. The seed and labour are frequently, under such circumstances, thrown away. It is more advantageous to plough, fallow, and clear the land thus uselessly employed, and prevent the accumulation of fresh seeds from crops of weeds which invariably rise amongst a corn-crop, that does not overpower them by its luxuriance of growth.

GENERAL CHARACTER OF THE DISTRICT.

This district contains no land of better quality than that of medium value; consequently, some branches of agriculture carried on in richer land are here unknown. No horses are bred,—no considerable dairies exist,—very few cattle are fatted. Some oxen and cows have been prepared for

the butcher, by feeding them in stalls upon Swedish turnips and hay; but even that practice is not common. The grazing-land is found only in small quantities, and the quality of it is seldom good enough to forward the cattle sufficiently before they are put in the stall, much less to prepare them for market, without being stall-fed.

Beans and peas are rarely seen; such crops on these soils are very precarious. It is far cheaper to purchase such articles from districts better suited to their growth.

Notwithstanding the thinness of soil which prevails in this district, the crops suffer less in dry seasons than the appearance of the land would indicate. The chalk is retentive of wet, and communicates its moisture to the roots of the growing crops sufficiently to protect them against the injurious effect of heat, and gives them an advantage, under such circumstances, they would not enjoy in land of better quality.

The inferiority of soil is recompensed, in some measure, by the salubrity of the air. The diseases common to very deep or marshy soils scarcely make their appearance; and except low fevers, originating in poverty and want of warmth, no epidemical disorders prevail. The fields have been mostly inclosed under acts of parliament; are of large dimensions, and of a regular, uniform appearance. The hedges are not thick or high, or mixed with timber trees. The whole country is fully exposed to the currents of wind, and in wet seasons the corn is far more easily secured than when a luxuriant growth of timber, woods, and fences impede the motion of the air.

Drill-Husbandry.—The experiment of the drill husbandry was tried on this farm for a succession of years. Neither diligence, patience, nor expense, were spared, and occasionally the drilled crops were superior to the broad cast; but it required a combination of favourable circumstances to produce this result. Upon the compact gravelly clay, the difficulties in wet seasons were insurmountable, and a season was sometimes lost in expectation of weather suited to the drill. Whatever may be its advantages on loamy or sandy soils, it certainly does not succeed on a farm consisting of the soils the nature of which has been described. It has been tried by other persons of this district; but as a system for a whole farm, no one has persevered in it. From the time of Tull (the founder of the drill husbandry), some writers have continued to recommend the practice upon soils of all natures, and attributed the neglect of it to the ignorance and obstinacy of the farmers; but notwithstanding these high authorities, unless instances could be produced of its success upon land like that of this district, it will be doubtful whether the writers or farmers are most deserving of such imputations.

PLANTING.

The planting of trees is not necessarily connected with farming; but it forms a part of agricultural pursuits.

In the soils, the nature of which has been described, no trees of any description grow with luxuriance, without the assistance of trenching the grounds; but when this practice is adopted, they grow with vigour and beauty, and attain considerable size. The depth of trenching depends on the quantity of the soil; in the gravelly clays and gravels, frequently it may be dug two feet and a half deep; on the light soils the chalk rubble begins to appear at five and six inches; in the latter soils it is not advisable to trench below the depth of a foot.

Neither the larch nor fir is suited to chalk soils of little depth. When-

ever they attain a size which compels the root to come in contact with the chalk, they turn yellow and perish soon. But many useful trees flourish in this soil; the beech, birch, sycamore, plane, poplars, and yew, are well suited to such ground.

CAPITAL AND ACCOUNTS.

There are two subjects connected with agriculture which cannot be too strongly recommended to the attention of farmers, but which they generally neglect in a manner very prejudicial to their affairs.

Necessity of Capital.—Farmers in general do not take the precaution of being prepared with funds of ready money, and they are consequently driven to sell their produce from contingencies they do not always anticipate, at times when their commodities must be disposed of to a disadvantage. Franklin has observed, that there is a difference of ten per cent. between *Will you sell?* and *Will you buy?*—and it is want of attention to this well-founded axiom, that prevents the farmer from being empowered to wait for the question *Will you sell?* The farmer is a sturdy bargainer, and will drag out a contention about price to a tedious length; but if his customer be aware that a sale is indispensably necessary to the affairs of his competitor, the buyer is sure to carry his point. The credit, the show of a little capital, confers an advantage on the farmer in these contests, and can alone put him upon a level with his antagonist.

Accounts.—Few farmers keep any accounts: at the end of the year they make a rough calculation of the value of the capital and stock that remains, and from such computation they collect the amount of their profits or loss. But if agriculture and farming be really a science, and is to be conducted on the most advantageous system, a distinct account of the several heads of expenditure, and the amount of the several distinct articles produced in quantity and value, is indispensably necessary. Without some account of this nature, no reference can be made to ascertain the average amount of the crops, and there can be no means of determining which are raised at the least expense, and which are the most profitable; nor in what parts of the expenditure a retrenchment can be best made.

Many modes of keeping accounts have been recommended, but the objection to them in general is, that the divisions are too refined, and are too complicated for farmers of common acquirements. They have not time to attend to a minute detail, nor instruction sufficient to render it easy in practice. Some few heads are suggested at the end of this paper, under which they might arrange their expenditure and receipts; and as they become familiar with the method, they can afterwards be carried into more minute details.

LABOURERS.

Causes of Distress.—The situation of the labourers, and of the whole class of agricultural poor, has attracted, for a considerable time, the attention of the country. The sources of their present destitute and comfortless state have been examined with industry, by individuals well qualified to investigate this subject; and it is admitted that the principal cause of their misery is the want of employment. Upon that point there is little dispute. In finding remedies for this increasing evil a difference of opinion arises. Some political economists propose to leave the labourers to find their own way out of the difficulties. Others suggest expedients to alleviate the pressure for a time. As the complaints of distress are very general in all branches of industry, the agricultural poor appear to be suffering in common with those other portions of the community, whose subsistence does not depend upon a settled income. But the labourer suffers in a greater proportion: his

gains in the most favourable periods do not much exceed the amount of the sum required to purchase the bare necessaries of life; he has no superfluities; and whenever a reduction of his profits takes place, no economy can supply the deficiency. The means are withdrawn by which his health and strength, his sole property, can be preserved, and the term poverty is not a metaphor when applied to him, as it often is when used with respect to higher classes, whom a change of circumstances only makes poor by comparison with that which they possessed before. Their means of existence are at this moment so closely pared down, that the reduction of three pence per week is become a serious defalcation of income.

If there be any laws resulting from the institutions that establish property in land which necessarily limit, in a country fully peopled, the share of the labourer to a portion which can only procure for himself and family a bare subsistence, it is vain to seek any considerable improvement of his condition, and the government can do no more than protect him in the enjoyment of the part allotted to him, and be cautious that they do not, by any of their measures, expose him to unnecessary hardships.

The doctrines and theories of the economists, to explain the principles upon which the produce arising from land is distributed between the owner and the labourer, do not favour the supposition that, in general, the situation of the agricultural poor is susceptible, in ordinary circumstances, of great improvement; and, unfortunately, we find no facts at other periods, or in other countries, to make us doubt the correctness of their reasoning. History does not deal much in the records of the poor; but from the little which can be collected of their state in the early and middle ages and at some later periods, they appear, in our country, to have been then subject to greater evils than infest them even at the present moment.

The situation of the peasantry in other countries affords no ground for more consolatory views. The Netherlands furnish an example of a state said to be well governed, and of a fertile country; the land appears to teem with plenty; but no English labourer would exchange his present condition, his comfortless cottage, his small allotment of a wheaten loaf, for the worse hovel and black barley-bread of the Flemish peasantry.

The revolution, and the struggles which preceded it and of which it was the consummation, laid the foundation of the permanent greatness of this country, and of its riches, its power, and prosperity; and it is impossible not to believe that some portion of these benefits were communicated to the working part of the community; their comfort must have increased in some degree, with that of other classes, and the period after the commencement of the last century, for seventy or eighty years, was, probably, that in which they had most reason to be satisfied.

A great rise in the amount of the poor-rate, seems to present the best indication for fixing the period at which, during the last century, the welfare of the agricultural labourer began to decline. In the parish in which the farm before described is situated, the whole sum collected annually for the use of the poor and of the county-rate, until the year 1779 and 1780, did not exceed 27*l.* or 29*l.*; and by reference to the details found in the accounts of the overseer, the money so collected was expended in payments of 2*s.* 6*d.* per week, to three or four widows, and occasional relief to persons afflicted with sickness. There is no reason for believing this parish to be circumstanced differently from the others included in the district, and any inference deduced from its example will probably be nearly true as to all. No manufactures are carried on in it; the population is entirely agricultural. Since the year 1783, the population of the parish has gradually increased about a third;

few new cottages have been built, but many have been pulled down, so that the means of accommodation being lessened, the inhabitants are compelled to crowd in heaps under the same roof; families are mixed together by necessity, in a manner which deprives a father of any power of selecting the inmates of his house, and all control over the morals and habits of his children is usually lost.

Previously to the year 1783, and for some years subsequently, a few labourers were owners of cottages and gardens, on leases for lives, and they afforded the most favourable specimen of the state of comfort that a labourer might possibly attain. The whole of this class have disappeared; most of them were compelled to sell their property before the expiration of their tenancy, and it is believed no lease has been renewed.

From 1780 the poor-rate and county-rates in this parish, gradually increased, and have since that period, within the present century, amounted sometimes to between 600*l.* and 700*l.* per annum; whilst the rental upon an improved state of cultivation, which nearly doubled the produce, has certainly not been augmented a third.

Taxation.—The year 1783 terminated a disastrous and costly war, which fixed on the country permanently n heavy weight of taxation, and the war which was concluded in 1815, with so much glory and at so enormous an expense, has certainly not diminished the burthen.

It is difficult to ascertain, with precision, the proportion of taxation which bears upon the labourers; it falls on the means of their subsistence through so many channels, and in such shapes, that the detail is involved in great obscurity, and the proof of it is exposed to every species of cavil. But it is evident, the farmers will endeavour to seek an indemnity, in some degree, for the burthen which, directly or indirectly, is imposed upon themselves, and compel the labourer to pay some proportion of it by a deduction from his wages. It cannot be prevented by any expedient that will not vest a discretionary power in some officer or magistrate to settle the rate of wages, a method to which the objections are insuperable.

Wages.—The power of making such deduction is placed in the hands of the farmer, at present to a degree nearly indefinite, by the want of employment for the poor. The competition for work amongst the labourers is so great, that they underbid each other, and leave the bargain entirely at the discretion of the master. This authority is, undoubtedly, sometimes much abused, and generally carried to an extent which compels the labourers with families to seek the supply of some part of his deficient subsistence, through the intervention of the overseer and the magistrate.

Excess of Population.—Whether this state of circumstances proceeds from a real excess of population, or from a diminution in the profits of the farmer, which at present disables him from employing a greater number of labourers, the immediate evil is the same; but these causes differ in their ultimate results. If there be a real excess of population, which cannot be absorbed by some more perfect system of cultivation, or by a greater extent of it, the mischief will be more difficult to remove, than when it proceeds from an occasional depression of profits.

There are three causes which will probably, in this district, operate to prevent this increase of employment: first, the more extensive use of machinery, which, in defiance of its present unpopularity, will ultimately take place; secondly, an extensive conversion of pasture into arable in Ireland; and next, a more unrestricted importation of foreign corn, to which all the principles now avowed by the majority of the people, and of the able men in Parliament, inevitably lead. Whenever this last point is carried, combined with the cheapness of labour in Ireland, and the fertility of Irish soil,

the growth of wheat upon the very light land of this district must be abandoned, and it will resume its ancient state of down.

The general complaints made against the labourer are, his supineness, carelessness, and want of energy. Such complaints are, perhaps, in some measure, founded in truth. These defects arise principally from his being aware of the contracted limits within which he is during the period of his existence destined to move, and by his mind being rendered torpid by a dependence on every occasion on the commands and direction of a master. He knows that the utmost exertion of his talents and strength makes but little difference in the reward; no real or delusive prospect of wealth, or ease, is opened to his hopes; nothing is left to his ingenuity or invention; and he is excluded by his insulated station from any familiar intercourse, with the means of acquiring knowledge, or enlarging his views. But such causes will operate equally unfavourably on every class of mankind who are exposed to similar disadvantages, and no peculiar blame attaches to the agricultural labourer.

POOR-LAWS.

The policy of the poor-laws has often been questioned upon the ground that the labourers are induced to rely upon them as a resource, and that their provisions give encouragement to idleness and indulgence. That they produce this effect in some degree cannot be denied; and if the sufferings of the labourers were to be wholly attributed to their own misconduct and to the provisions these laws contain, they should be repealed. But the misfortunes of the labourers are often the consequence of the errors of their rulers, and of contingencies which human reason can hardly foresee. We are indebted to our forefathers for the balance of good or evil of this system; but interwoven as it is in our political existence, humanity, policy, and necessity, appear to forbid at present that it should be abandoned.

These laws are certainly capable of a better administration, and the evils which result from them admit of alleviation. The magistrates do not sufficiently examine the circumstances of the case of each individual and of each family; they establish a general rule by which a certain sum per head, including the amount of their wages, is allowed, equal to the purchase of a gallon loaf each week, and in some places 3*d*., and in others 6*d*. is given for other contingent expenses. This rule is rarely a fit measure of the wants of the persons relieved, and it excludes the consideration of the merits of the individuals, and a scrutiny as to the causes of their wants,—points which always should weigh in the magistrate's determination, as his power is discretionary.

Assistant Overseer.—The parish in which this farm is situated has derived great benefit from the employment of a permanent assistant overseer, who is paid for his trouble by a salary. It is his duty to make himself intimately acquainted with the situation of every family or person who usually claims relief, with the amount of his wages, the persons by whom employed, the number in each family, the ages of the children, their health and various wants; and to be prepared at all times to give every information concerning these objects to the vestry or any of its members, without whose consent and directions (except in cases of necessity) no relief can be given. By these means frauds and impositions are detected, and such is the difficulty of practising them, that they are not often attempted. Since this plan has been adopted, the amount of the poor-rates has been gradually abating.

The salary paid to an assistant overseer raised at first great objection to the appointment in the minds of the farmers of the parish, who saw nothing

in the project but an addition to the poor-rate. They acquiesced with great reluctance in the scheme; but the evident advantages resulting from it, in the regularity, order, and satisfaction of the labourers, and the diminution of the rates, have fully reconciled them to the experiment.

The practice of appointing two farmers of the parish as overseers, without an assistant, is objectionable. Such persons are in general sufficiently occupied with their own business, and have neither the time nor the inclination to examine attentively the detailed concerns and conduct of every family claiming relief; they are apt to be governed by partiality and prejudices in the administration of the funds entrusted to their care, and before they have acquired a competent knowledge of the state of the parishioners, the term of their authority is expired.

CHARACTER OF THE PEASANTRY.

In general the opinions which exist in favour of the poor-laws are more founded on commiseration and humanity, than on any deliberate and deeply considered grounds of policy; and the labourers should not be deprived, by misrepresentation or unjust imputations on their habits and behaviour, of the advantage they derive from such feelings.

We should be cautious in deciding on the general character of any class of society, from observations made on a few individuals belonging to it, who attract attention by their conduct. Whenever a person in the station of a labourer becomes remarkable and generally known, it is usually by some habits offensive to the community, and injurious to himself and his family. It is not the least of the evil consequences which result from such behaviour, that the whole body of the individuals of his own rank are involved in common discredit with him. But the virtues of a labourer rarely produce any conspicuous effect. His worth, however considerable, is so darkened by the obscurity which surrounds him, has so little influence on the community, that it presents no prominent feature from which any inference is ever drawn, as to the qualities of his equals and companions. It will not, however, escape those persons whom either duty or inclination induces to examine without prejudice the manners and dispositions of the agricultural poor, that great variety of character exists amongst them, and that the number of those who are inclined to vice does not exceed the proportion included in more elevated classes. Their defects are often compensated by the most signal virtues which can adorn our nature; by an affectionate attachment to their families and children, by a humane and disinterested kindness to their relations and friends in sickness and distress. They make sacrifices in the performance of those duties rarely exemplified in persons upon whom knowledge and religion have more amply shed their united influence. The labourer will seldom refuse any assistance which is offered by private charity, but in general he is by no means intrusive, and bears his privations with fortitude and resignation. Some of them resort to expedients to relieve their wants by petty offences; but examples of crimes, of great magnitude, are not often found amongst them.

Means of improving them.—The best mode of paying the labourer is, permitting him to work by the piece. He then exerts his full strength and talents, and gains something more than his customary daily pay. It leaves the time of working and the arrangement as to his meals, more to his choice, and, on some occasions, the best and readiest mode of performing his labour is left to his ingenuity. The plan is quite practicable in most departments of farming, and is often advantageous both to the master and the workman.

Medical Aid.—The most useful charitable assistance which can be afforded to labourers is a medical adviser. Their destitution prevents their application to the surgeon or apothecary, unless such person is provided for them; and diseases which might be easily subdued in their early stage, are thus suffered to increase; and in the case of fevers often spread the contagion through a village. There is no assistance for which they are more grateful, and none which the public are more interested by policy and humanity in affording. The poor learn from the regular practitioner the remedies for common complaints, and common bodily injuries, and are taught by him the necessity of cleanliness, from the want of which their diseases often originate. They abandon the use of quack medicines, and their own useless or hurtful nostrums. In the parish alluded to, the apothecary is paid a salary, and the duty is performed with regularity, and satisfaction to the poor; from him the best testimony is obtained as to their wants, and he is a useful mediator for them with the overseer and the magistrate.

Gardens.—The nature of the soil in this district does not render it advisable to give the head of a family a portion of land larger than that which is suited to be a garden. In rich soils, and in grazing countries, the experiment of allowing each cottager to rent sufficient land to maintain a cow may be tried; but a larger extent of land, of the nature before described, than that which can be cultivated by the spade, would remain unemployed. This land bears nothing useful spontaneously. It is only by manure, cultivation, and considerable labour, that any valuable produce can be obtained. A plot of ground from thirty to forty poles is as much as the labourer in general desires, and as much as he can keep in condition. But such an extent of land is of essential service to him. It adds some change of food to his table; the work necessary to render it profitable fills up his leisure hours; it employs his children; and, by furnishing a spot where filth may be deposited and buried, prevents its accumulation in the immediate vicinity of the house.

Separate Dwellings.—The expedient, however, of allotting land as gardens for the labourers is far from being generally applicable at present, as a mode of relief. A garden, to be protected, must be close to the residence, and few labourers are masters of a separate cottage. Different families are, as it has been stated, usually accumulated under the same roof. This community of existence and possession, in which the good and the bad are mixed without distinction, deprives the industrious of their excitement to labour. They are harassed by interruption of the idle; they are exposed to pillage, and invariably to the dispiriting hazard of not reaping what they had sown.

These aggregations of the poor are attended with all the disadvantages of a workhouse, without the regularity which results from its rules, and the authority of the master. They are filled with dissension and discontent. They promote immorality by the contiguity of the young of both sexes, and, by a familiarity of manners and examples of indecency, deprive even childhood of the interest which innocence usually excites.

Whatever attempts are made to ameliorate the condition of the poor, they must be accompanied by a redress of this destructive grievance. Unless a father has the means of protecting the morals of his children, he cannot be made responsible for their conduct, and if he finds the means are not within his power, he releases his conscience from the obligation. The reproaches for the offences which emanate from these semiuaries of disorder attach to the body of the individuals thus promiscuously thrown together; the virtuous lose the credit which belongs to them, and share the imputations with the guilty. Despondency often seizes on the minds of the

portion whom nature or habit had formed to feel disgust at vice and immorality, and they linger on in a state of apathy, careless of the present, and hopeless of the future.

It is not easy to suggest remedies for disorders which threaten to sink the agricultural poor into a state of barbarism, and a long lapse of time will be required to re-establish this class of persons in their former state of comparative comfort. Their excess, however, in numbers, (if it be true that it exists,) originated in causes, and sprung from a combination of circumstances, not likely again to arise, and against the recurrence of which the increasing intelligence of the country and the weight of public opinion will certainly guard.

Residence of Landlords.—In measuring the quantity of evil which afflicts, comparatively, the different sections of this district, it is impossible not to perceive, that, generally, those in which the owners of the land and persons of education are resident, are subjected to the least share of the common calamity. It is difficult for persons of any refinement in their feelings, to live in the midst of a population, dependent in a great measure on their control, and not to interest themselves in its sufferings. Wherever such interference is conducted with good sense and activity, their authority and example will always succeed in effecting the execution of any scheme which affords a prospect of improving the condition of the poor. The farmer has only a temporary interest in the soil he rents, he has no permanent bond of connexion with the labourer of the parish, and cannot be actuated by the enlarged views which should lead the landlord to consult his own advantage, by contributing to the welfare of the peasant.

The owner of land who absents himself from his property without com pulsion cannot easily justify his conduct. The ways both of good and evil are left open for our selection, and the absentee furnishes an instance of the liberty often taken in making the choice. Residence cannot be enforced by legal authority, but landed property may be considered as a benefice, on which residence is morally required. The right to property is an institution of society, founded indeed in justice, and essential to the prosperity of mankind. But some species of property confer greater privileges, and possess advantages, which do not so eminently belong to others. The owners of land are invested with a power, influence, and consideration, which do not flow, in the same degree, from pecuniary and commercial wealth. They possess the signal advantage of being able to contribute to the prosperity of the persons necessarily dependent on them for a portion of their happiness, without sacrificing any essential interest. They can, by a wise distribution of their property, equally promote its improvement and the comfort of the labourer. They can remove some of the causes which corrupt his morals and repress his industry. They can protect him by advice against his ignorance and prejudices, expose the arts by which he is commonly defrauded of the full benefit of his earnings, and be his leader and his friend. If landed property confers such powers of doing good, the neglect to exert them is a breach of duty.

Marriage.—Whatever schemes may be proposed for diminishing the wants of the agricultural poor, none must be built on enforcing the supposed virtues of the cloister. The promiscuous intercourse of the sexes and habits of incontinence may be corrected, but the right of marriage cannot be controlled, except by the prudence of the parties, or even discountenanced amongst the poor with safety. The poor-laws are supposed to afford an inducement to the labourer to enter into the marriage state, by the resource they hold out in maintaining his children. But the passions implanted in

him by nature, and motives arising from convenience, present irresistable temptations. The want of a helpmate is felt far more by the poor than the affluent: their meals, their cleanliness, their physical comforts depend on the assistance of a wife. The increase of expense is generally compensated by better management and economy: they contract habits of abstinence from love to their children, for whose benefit they will refuse indulgences within their reach. Marriage with them is the source of many virtues, the preventive of many disorders,—springs from their wants, is sanctioned by religion and policy, and by the inestimable benefits it confers on the different sexes in their rank. Few of them meditate, on contracting this connexion, the assistance of the poor-laws. They engage in it with the hope of happiness natural to youth, and with the short views of futurity, incident to their station no doubt, but in some degree incident to their species. The prospect of an allowance extorted from the reluctant hand of the overseer and magistrate rarely forms any part of their illusions.

The increase of the agricultural poor within the last thirty or thirty-five years was the effect of an enormous expenditure of the public capital, and of the facility with which the farmers obtained money from the country banks. These causes gave full activity to their employment, work to every hand, and subsistence to every family. The excess of population, compared with the means of employment, only became apparent, when the expenditure ceased, and the currency approached to its former value. The revulsion which took place was sudden, and deprived a large portion of the community, at once, of the means of existence. No outlet could be immediately found for this mass of destitute labourers and their families. In ordinary circumstances, whenever a pressure from the density of population became inconvenient, a drain to other countries would easily relieve the burthen. Time only can now restore the population to its proper balance, either by an increase of the means of employment at home, or by its slow and gradual effluxion to the colonies.

GENERAL OBSERVATIONS AND MAXIMS FOR THE MANAGEMENT OF A FARM.

Arranged under the title of the Month to which they are applicable.

JANUARY.

During the frosts of this month carry out faggots, poles, and timber; draw out manure, chalk and marl land. This employs the teams which cannot be used for other purposes. In wet weather, storms, and deep snows, sheep should have some hay daily with turnips; turnips alone are not sufficient, hay is now well bestowed upon them; it keeps up their strength and enables them to go through their lambing. Ewes and lambs are often lost by a wrong-calculated frugality in this respect. If you fold sheep, choose the most sheltered spots, consistently with the plan of the future crops; ewes and lambs are much injured by too long exposure to severe weather. It is a good plan in bad weather to bring the sheep into yards, and it is best to separate the strong from the weak; the former drive the latter from their food.

If cows calve this month, contrive to have some cabbages, turnips, swedes, carrots, or other green food besides hay. Hay is the most expensive food in all places, and when given alone is not so productive of milk.

FEBRUARY.

As very cold weather generally prevails this month, the rules respecting stock still remain applicable as in January.

Plant beans early this month. If possible, finish the planting before the end; late crops do not succeed well. They should be dibbled about three inches apart, and carefully covered with mould pressed moderately on them. The common little horse-bean is the best, and more marketable. Growing higher than other sorts, it yields a greater quantity of straw. It grows best on rich dry sound loam.

This is the proper season for sowing black oats and hardy peas. The white pea is more tender than the grey.

Manure grass lands with soot, coal, wood ashes, lime, &c.

Marling may go on profitably.

MARCH.

This month sow barley. If all other circumstances are equal, the March will be superior to the later sown.

Increase the quantity of seed as the season advances. If four bushels are sown in February, five should be sown the end of March.

Sow white oats; the land should receive the same preparation as for barley.

Clover. There are several methods of sowing this; but the surest is to broad cast and harrow it in at the time barley is sown. Ten or twelve pounds is the usual quantity of seed, but fifteen are better.

Sow upon light sandy soils trefoil, with a portion of white clover and rye-grass. Six pounds trefoil, four white clover, half a bushel of rye are the common quantities.

Sow sainfoin. Sands upon chalk are its favourite soil; also loams and clays in a shallow stratum on limestone. No crop is so profitable. Six bushels an acre broad cast.

Sow now all sorts of peas not sown before. All stock ewes, wethers or lambs, should now be well kept. If pinched now, all money before expended is thrown away.

APRIL.

Barley crops not sown in March should be in the ground by the middle of this month.

There should be two sowings of spring tares this month—one at the beginning, the other at the end. Three bushels per acre.

Sainfoin may be safely sown.

This month tries the farmer more than any in the year. Pieces of clover and rye-grass grown on land in pretty good heart, should succeed as feed for sheep after the turnips; swedes are very useful this month; they should be pulled up to prevent their running up to flower, and becoming fibrous and hard. If pulled up they get mellow and last on the ground good until the end of May. No turnip should be in the ground after March.

Markets for beef and mutton are usually high towards the end of this month. Beasts really fat are sure to sell well at Smithfield.

Do not be anxious to get your cows out of the farm-yard. Swedish turnips and chaff are good food for them. Turning cattle out before there is a good bite is unprofitable.

The end of this month is the best season for planting potatoes.

This month must conclude the business of fences; it is bad husbandry to cut hedges after April.

MAY.

About the 12th the farmer may calculate he will have a sufficient bite to leave off foddering. Buck wheat may be sown towards the end. It is a profitable crop on all land that requires late sowing.

Lucerne may be sown: being a perennial, when well cultivated it gives an immense profit—the land should be rich, and fine, and free from weeds. Potatoes may be planted through this month.

Swedish turnip. The best culture is to sow where it is to remain; not transplant them.

Hoe beans and pea crops if drilled. The drilling of peas on good loams or sands is an excellent practice.

Sheep should close-feed the grass. There should be no bent suffered to rise. Experience has taught the fact, that the way to have abundance of leaf, is to prevent the stems rising at all.

This month begins folding in all England. Many farmers give too slight dressings. The land should be black with manure if arable, with a good covering of grass.

Mind the dairy diligently this month. It is the most difficult part of farming at this period.

JUNE.

Turnips are the soul of the best husbandry. A succession of tares and turnips in the same year may be raised and consumed on dry land until it be made of any desired degree of richness. Turnips may be sown during the whole of this month.

A second or even a third sowing of swedes should be made and hoed as soon as they are in rough leaf, if the weather be not too dry. The cultivation in rows is excellent where the soil permits.

This month sainfoin clover and meadows are cut for hay. In mowing, make the labourers cut as close as possible; grass never thrives well that is not cut close, and one inch at the bottom weighs more than several at the top.

Sheep that are kept in inclosures, and especially in a woodland country, should be examined every day lest they be fly-struck. In twenty-four hours it may be almost past cure. Melt some butter, and stir in a sufficient quantity of flour of brimstone until it is of good consistency; a piece of the size of a small walnut is to be rubbed between the hands and drawn along the back of the sheep. Maggots should be dislodged with a knife, and a small quantity of white lead scraped from a lump put amongst the wool, which being shaken the powder is carried down to the wound.

JULY.

This is the time for hand-hoeing turnips. Turnips sooted about twenty-four hours after they are up, appear to be protected against the fly.

Crops of potatoes planted in rows should have a third horse-hoeing this month, or the ground well pulverised by a scarifier, fixed in a heavy iron beam, working under the ridge; afterwards throw up the mould by a double-mould board-plough. There is great use in this operation.

All meadows not cut in June should now be mowed. Hay-making in many seasons is ticklish work. It is a material point to have plenty of

hands. If good use be not made of favourable days, the work will be unprofitable.

Have an eye to your fallows this month. Do not suffer them to be overrun with weeds. You farm unprofitably, if you do not keep men and horses for all work.

Before this month goes out, lambs should be weaned.

Do not let the marl, chalk, or clay carts stop; it is a proper season for the work.

Be very attentive to the wheat crops; they are very liable to the mildew, which admits but of one cure, reaping it as soon as it is struck.

AUGUST.

Now the farmer ought to give his first attention to his wheat crops. Bad weather generally injures his profits. He must have many hands at work to make the best use of fine seasons.

Take care the men do not cut in improper weather, and that they make the sheaves in proportion to the quantity of weeds and ripeness of the corn.

Wheat stacks should be placed near the end of a barn, and a door or window made to throw it in. This saves much labour, and danger from being caught in bad weather.

Of all grain, oats take the least damage in bad weather. A shower or two is rather beneficial to them.

The barley crops should generally have good field room, lying five or six days after mowing: a heavy shower will not diminish the farmer's profit; it makes the grain swell and measure more per acre.

The custom of gleaning is universal, but the poor have no right to glean without the permission of the farmer. He should permit under such rules as prevent abuse; but let him not suffer his pigs or cattle to interfere with the gleaner; such little profit should be allowed the poor.

The second hand-hoeing of broad turnip crops must be now given, and should not be omitted on account of other harvest work. Sell lambs this month; it is advantageous.

SEPTEMBER.

The cultivation of tares is extending every year. They make, with turnip crops, the arable farms support as much stock as the grazing. During the time they occupy the ground, they produce as much green food as grazing land.

Immediately after the corn is carried, or even partly carried, plough the field and sow tares, and where no manure is used, in some soils the seed may be harrowed in without ploughing.

Mowing the tares, and feeding the sheep in cribs with them on the land, is a good method.

Upon all cold, wet, and backward soils, September is the best season for putting in wheat, provided the land be not too dry. Upon drier and warmer soils, it is better to postpone it to October.

The red straw Lammas wheat is reckoned by many farmers the best of all the sorts hitherto known, yielding the finest and whitest flour; but still the white sorts of wheat sell dearer.

Steeping the seed in a solution of arsenic is said to give clean crops from smutty seed.

You must be very attentive to your fatting beasts: a beast nearly fat must have plenty; he is nice, and, if at all curtailed in pasture, will fall off.

OCTOBER

At this season farms are taken; do not be captivated by seeing large crops on the land; examine well, at the same time, by what expenses they are raised.

Soils formed by water are amongst the richest which are found.

Grass fields on gravelly soils, if the gravel be sharp, are apt to burn in dry summers; but they give great and sweet crops in wet ones.

Contiguity of fields is of great importance; many farmers overlook this circumstance. Straggling, disjointed fields are most perplexing, and a great drawback on profitable management.

This may be the last month of cattle remaining abroad; and if so, the farm-yard should be in order to receive them. In hiring a farm, a man should attend much to the goodness and convenience of the yards.

About the latter end of this month, horses must be put to dry meat, hay, oats, and chaff. The Flemish give no water to their horses without making it into a white soup, by the addition of meal of corn of low price. No horses in Europe are better managed.

In stocking a farm, it is often a question whether to employ horses or oxen. In counties which do not possess a breed of horned cattle, and have no land for fattening, it will not answer to employ oxen.

Dairy cows must be taken into the yard, and their food varied according to their state.

NOVEMBER.

This is the first month for hedging and ditching, October is too soon.

The stock of lean sheep may still be fed on the remains of the summer grass; but the fat stock must have turnips and hay. Remember that fat cattle should have as much feed as they like, but should be prevented making waste.

There is little doubt that salt may be used in such manner as to preserve the health of sound sheep, as well as to cure such as are rotten; it may be given in their hay, or you may drench them with brine of proper strength.

The black scour, or other diarrhœa, in sheep, it is said, may be cured by giving salt.

Drilled swedes should now be covered with mould. It may be done by a light double-mould board-plough.

DECEMBER.

Threshers must be kept constantly at work this month, that the cattle may be fed with straw-chaff. Use the worst straw first; every change of straw should be for the better. Wheat straw makes the worst fodder; oat comes next; barley the best. Do not be without a threshing-machine, if you can afford it.

Pigs should be littered; they make the best manure on the farm. In the management of store swine, oats are preferable to barley. Young pigs require warm meat to make them grow.

Keep the hedgers and ditchers close to their work this month, that they may be ready for other work in the spring.

Sheep that have been reared, and constantly fed on chalk hills, are free from the rot, as long as they continue in that situation. Sheep may be cured of the rot by management, or medicine. Winter them in straw-yards where they have sheds to keep them dry. The disease of the rot is similar to dropsy.

ACCOUNTS.

It is recommended in the first place, that the farmer should make a general daily entry in a book, of his receipts on one side, and his payments on the other; together with such observations and occurrences that should be recollected, for the best management of his farm, and should afterwards, at his leisure, digest them under the following heads:—

Annual payments to farm servants. Weekly payments for labour, including work done by the piece or quantity, distinguishing the threshing of wheat, barley, &c.

A separate head for—reaping, mowing, and hoeing.

Ditto—fencing, making hedges, and ditches.

Ditto—tradesmen's bills, as blacksmiths, wheelwrights, &c.

Ditto—repairs of buildings of all descriptions belonging to the farm.

Ditto—taxes, assessment, poor, and other rates, tithes, rent.

Ditto—seed of all sorts bought for sowing.

Ditto—hay, corn, bought for consumption on the farm.

Ditto—dead stock bought.

Ditto—live stock bought.

Ditto—payments for manure; such as ashes, lime, &c.

Ditto Extra Expenses; such as allowances to carters for long carriage, turnpikes, beer, and a number of small out-goings which constantly occur.

Wheat crop.—Number of acres reaped; how much winnowed sold, consumed in family, sown, and otherwise disposed of.

Barley, ditto.

Oats, ditto.

Ditto beans, peas, tares, and hay and other pulse.

Number of sheep on farm,—sheep, lambs, and wool sold, or otherwise disposed of.

Pigs, ditto.

Other cattle according to the nature of the farm.

Butter, cheese, milk, and calves.

Poultry, eggs.

Extra profits on small articles sold; for carriage when hired, &c.

Wood.

This method of keeping accounts is framed for the use of common corn farms. When the farmer has practised this plan for two or three years, he will easily make such further divisions as he may find desirable. But the mode first tried must be simple and very intelligible. He will find out, from thus dividing the heads of expenses, the departments where the weight of the out-goings mainly presses, and may curtail and economize in such as may admit of some saving.

FARM REPORTS.

II. KYLE IN AYRSHIRE.

Introduction.

There is no way in which a farmer may more advantageously improve himself in his art, than by inspecting the practice of other districts and of other countries, but as the opportunity of inspection cannot always be commanded, the want may be supplied by obtaining circumstantial descriptions. To derive the full benefit from either source requires caution and the power of discrimination; for in no art do so many circumstances combine in the production of the results as in agriculture, and a difficulty generally arises in determining to what cause a particular effect is mainly to be assigned. Individual sagacity without scientific knowledge may go a great way in solving this difficulty, and in determining to what extent an old course may safely be altered, or a new one introduced, or why failure or success has ensued. We find that, in a certain place, the accumulated sagacity of ages has, without being able to ascribe any general principle for the effect produced, established a practice suitable upon the whole to the circumstances of the situation—but if the perfecting the art in every situation be the object, the necessity of scientific knowledge cannot be too strongly impressed.

Theoretical and practical farmers have been sometimes contrasted to the discredit of the former. A mere practical farmer is a man who knows how to manage to good advantage a certain piece of ground. A mere theoretical farmer is a man who understands the principles on which the operations of agriculture depend, without having acquired dexterity in their application. The one may be less successful than the other at first, but place them in a new situation, or let them have to determine on the introduction of a new practice, there can be little doubt which of them, supposing them equal in intellectual endowments, will be most likely to succeed—or in the description of the farm to be here given, which will be most likely to detect what part of the system is erroneous, and what correct. Experiments in agriculture are carried on under many disadvantages. We have it not in our power to vary at will the circumstances in which they are tried, or to repeat an experiment in precisely similar circumstances, and thus we may be led to ascribe to a cause what does not justly belong to it. Fortunately, however, the results in agriculture have their foundation in sciences, in which we have sufficient control over circumstances, and in which the facts can be generalized, and principles established with the completest certainty. Chemistry and vegetable physiology afford the only sure means by which the art of agriculture can be brought to perfection, and Davy and Sinclair have done more towards its advancement, than might have been accomplished in centuries by practice unguided by science. Much has been done where the knowledge of general principles was wanting, but their use is to diffuse the capacity for improvement, to make its progress more certain and more rapid, and to prevent the adoption of error. Some person may, for instance, have raised an excellent crop after dressing his land with salt, and thousands of bushels are immediately

applied as a manure, but no man who understood chemistry and vegetable physiology would ever have imagined that land could be made more fertile by such means.

There is every reason to expect that these sciences will soon be more generally understood. In towns, the means of acquiring the knowledge of physics is supplied to mechanics; and all other classes will be forced to keep pace with them. It seems absurd that any human being who can be kept at school for eight or ten years of his life, should arrive at the end of his education, in ignorance of the laws by which the events in nature around him take place. In relation to the aptitude of the human mind, this branch of knowledge might well be taught prior to that which is denoted literature, at least the one should accompany the other, and it is not difficult to conceive plans by which it might form a part of the course of instruction in even every country school, without much additional demand of time or of expense. The usefulness of the knowledge here recommended is very obvious, and it is unnecessary to insist on the amount to which it would add to the sources of pleasure to all farmers, whether proprietors or tenants. Every landowner living in the country, is to some extent a farmer, or a planter, or a gardener: there is not an object around him that can occupy his attention for a moment, in which his interest would not be much increased by the understanding of physical science, and yet what class in society is so generally unprovided with this fund of intellectual recreation and resource against the tedium of idleness?

DESCRIPTION OF THE FARM.

This farm, which lies in the district of Kyle in Ayrshire, contains 250 arable acres, imperial measurement. Its offices are centrical. Its inclosures, which are rather unequal in size, are remarkably well accommodated with good roads. It is above seven miles distant from any place where manure can be got in considerable quantity, and two acres and a half are the most that have ever in one year been dunged from extraneous sources. In the above measurement are included five acres of rich sandy loam on an open subsoil, about four acres of mossy or peaty ground, and thirteen or fourteen acres dispersed in different places, of a deep alluvial clay soil. Generally speaking, however, the soil is poor, and rather tenacious, and, though very various in depth, may be stated at fourteen or fifteen inches as an average. The subsoil contains nothing noxious to vegetation, but is quite impervious to water. As in Ayrshire much rain falls through all the seasons of the year, the conducting of agricultural operations is, in these circumstances, extremely precarious and difficult. The ordinary farm establishment consists of a superintending servant, who directs the details and also engages in the farm work, two ploughmen, and two pairs of horses, two labourers, and a dairy-maid, besides a few female labourers occasionally weeding in spring and summer. By this force also a good deal of work not strictly connected with cultivation has been done. When the farm was taken possession of ten years ago, it was in a very exhausted condition. For seven years previously, the rotation had been either oats—oats—fallow—wheat—beans—oats—hay—followed by a few years pasture—manure applied to the fallow, but far too little in proportion to the extent and condition of the land; or oats—oats, without dung—hay—pasture for some years. Thus the land was in the one case too much exhausted before the fallow, and when laid down in grass, was in a poorer state than when broken up.

GENERAL SYSTEM OF MANAGEMENT.

The object since has been improvement, with a view to which, it has been endeavoured to get the fields laid down in pasture, in as good a state as the means of doing so, without too great a sacrifice of immediate return, would permit; and the rotations, adopted according as the land was more or less impoverished, have been oats—fallow with dung—wheat—hay—pasture for seven or eight years—or oats—fallow with dung—wheat—red clover and rye grass—oats—peas—oats with dung—pasture to be continued for at least four years. With respect to the first, none of the land thus laid down has yet been broken up, but it has returned as much in pasture as it could probably have been let for in its previous state under any system of management, and will, it is expected, yield proportionally well when brought again under tillage. With respect to the second, the crops, except the first one of oats, have been all good, and the land appears to be left in a good state to improve by resting. There are, however, two objections to it—the difficulty of getting a sufficiency of manure, and the difficulty—rather the impossibility, soil and climate considered, of keeping the land to the last from becoming foul. Probably a saving of manure might be effected with equal results, by applying the dung to the peas crop. A luxuriant pulse crop of itself fertilizes the soil. It draws much of its nourishment from the atmosphere; it protects the decomposable matter already in the soil, from exhaustion by the sun and weather, and adds to it by the decay of the lower part of its leaves under cover, and of the innumerable insects that infest them. In the only instance in which this mode of applying the manure was tried here, the crop was too luxuriant to be productive in grain, but the succeeding white crop was very large. A balance of future profit is sometimes sacrificed to immediate gain, and it is believed that it would be a considerable improvement on the system, were this pulse crop raised with a view solely to fodder.

Such generally has been the mode adopted for the improvement of this farm. Were it once all gone over, perhaps a change of system might be advisable, a more uniform system decidedly so.

Before entering on details, the management of three inclosures of the better land formerly mentioned may be adverted to, as they have afforded a considerable means of ameliorating the rest. For the five acres of sandy loam the rotation has been, oats—turnips—potatoes—wheat or red-clover; the crops always large. One inclosure of five acres of deep clayey loam, after fallow and wheat, was sown with rye-grass, cocksfoot, timothy, and white clover; and besides these, there is now in its herbage abundance of holcus lanat., several varieties of fiorin, poa pratensis, with some of the other indigenous grasses. It was drained, but not sufficiently, and a part of it is infested with ranunculus repens, called crowfoot or butter-cups, which, in hay, cattle will not touch. It has been cut four years successively in hay, yielding nearly six tons and a half annually, and has afterwards been pastured till December with sheep. By proper management it might have been rendered a still more valuable appendage to a farm on which green crops can never be extensively or successfully raised. It ought to be thoroughly drained, and preparatory to being laid down in grass would require to be pared and burned. From a trial made on about one-fourth of it, an occasional top-dressing of dung would amply remunerate. The other inclosure containing also five acres, is a very rich alluvial clay, with a considerable, perhaps too large, an admixture of vegetable matter. At no great distance of time it was a swamp. In the centre of it there is a hollow filled up with

moss, and springy, which has been drained, and the clay from the bottom of the drain and other sources laid to the depth of at least two inches on the moss, and it is now equally productive as the rest of the field. It was originally intended that this also should be converted into a permanent meadow, but the bulk of its crops has afforded a temptation to at least defer that object. When broken up, it was one mass of couch, the roots chiefly of a species of agrostis. It was fallowed in a very favourable season, got a moderate dressing of dung, and nine hundred and sixty Winchester bushels of lime, and was sown with wheat, drilled by an operation of the plough known under the name of "ribbing." Had the succeeding season not been remarkably dry, the wheat, from its strength, would have been lost. After being kept in stack for eleven months, the produce was two hundred and fifty-two bushels, and the produce in straw was comparatively greater than that in grain. Oats, hay, oats, potatoes, and turnips, have succeeded. The hay was bad; the field, should it ever be converted to permanent meadow, ought to be pared and burned, to extirpate the ranunculus. The oats were very bulky, the produce in grain of the two years together, four hundred and eighty bushels. This season the field is again in wheat, still a very bulky crop; but that after turnips is thin; and, considering this and the wetness and coldness of the season, the produce in grain cannot be estimated above a hundred and sixty bushels. Viewed merely as a source of manure for the rest of the farm, these crops have certainly equalled what would have been drawn from the field, had it been laid down, as first intended, in the best state as a meadow.

MANAGEMENT OF THE ROTATION OF CROPS.

1st. *Oats after Pasture.*—Were it not necessary to take advantage of the first occasion of the land being in a proper state for harrowing, lest another may not in time occur, oats should not be sown here till the middle of April. Before that period vegetation is so languid, that the plants are unable to resist the depredation of grubs; and if the land be poor, they never recover. The earlier and richer varieties do not succeed, and it is a material objection to them, that they are all deficient in straw; and on a farm dependent on the cattle-yard for manure, and on which green crops can be raised but to a small extent, this is a material objection.

2nd. *Fallow—Naked.*—It was once tried to fallow a very poor field without previously taking from it a crop of oats, but the breaking down of the turf sufficiently was found impracticable—the season, however, was remarkably wet and unfavourable. Five ploughings, with the usual assistance of the roller and harrows, are the most that have been found requisite to bring the ground into a sufficient state of cleanness and tilth for sowing. The ploughings should all be executed when the ground is in a dry state. The object is to clean, to pulverize and mix, and to render friable. One wet ploughing may undo the good effects of all the preceding operations, and had much better be omitted altogether. When lime is used, it is applied after the second ploughing, the dung is covered in with the seed farrow. There is no standard by which it can be said, with any degree of accuracy, what quantity of manure in the shape of farm-yard dung is applied. Carts are variously filled, and even when estimated by weight or measure, one is still in ignorance of the intrinsic value of the material. Where recent dung is used, if the land be very dry and loose, it is extremely difficult, in ploughing it down with the seed furrow, to bury it sufficiently, and when not well covered, a great waste is occasioned, and an obstruction offered in harrowing to sufficiently burying the seed.

Ridges of fifteen feet width were at first, for many reasons, adopted; they are conveoient in sowing and reaping, and when twice gathered, they afford, without rendering the furrows too bare, a quick escape for the water falling on the surface. When, however, the surface of the field has a considerable inclination, as is mostly the case here, twelve feet ridges are preferred. With these there is a less accumulation of water in each furrow, and the soil less washed away by the winter rains.

Fallow-green Crop.—A small portion of the most suitable soil of the fallow is often allotted to turnips and potatoes, both planted in drills with dung. The latter are almost always an inferior crop in quantity. If the season be dry and warm, very good turnips may be raised on this soil; but as such a season cannot be depended on, were it not for the sake of advancing a few young cattle, they would not be sown. To cart them off in wioter is ruinous for the land. For the last two years they have been stored towards the end of October, and with probably less loss than might have been expected, had they remained on the field. They are laid down on a dry place in long heaps about five feet wide, and moderately covered with straw. They should be protected from rain and frost, and at the same time the air not excluded from them. Swedes are the turnips which are most desirable to plant, but they do not succeed if not sown in the month of May. It is rare that the land can be got prepared so early, and therefore the yellow bullock is substituted, a root very little inferior, if to be used before the end of April. The potatoes are raised principally for the use of the servants and family. In winter, and when there is no whey, the pigs are fed with them boiled; and in spriug, when the cows begin to calve, they get a few bolls of them. The turnips are almost exclusively given to the young cattle.

3rd. *Wheat.*—Should be sown early in September. In proportion as it is sown later, it seems to be deficient in produce. One season a little was sown on the 13th August, and succeeded equally with the rest of the field; the spring, however, was fully more backward than springs are generally in this country. The white wheat is the kind that has always been sown, though perhaps not the most suitable. Three bushels an acre is enough; if sown later, or, when the land is very wet, a little more is required. It is washed in stale urine, and dried with slaked lime before being deposited in the field. It has, however, been repeatedly tried without washing, and in neither way has it ever been affected in the slightest degree with any disease. Sixteen and a half acres is the average extent sown annually since the farm was taken possession of. The average produce for each year has been as low as seventeen bushels per acre, and as high as thirty-four; and the average produce of all the years is twenty-five bushels per acre or thirty-one and a quarter per acre Scots.

4th. *Clover.*—Red clover, with rye-grass, generally succeeds well here. It affords the principal means of feeding the horses and calves in the house all summer and autumn. It is sown among the wheat most commonly in the month of March, and four pounds of clover-seed has always been found sufficient for an acre. A great part of the first cutting is converted into hay, and made early for the sake of the after-crop of clover.

5th. *Oats after Clover.*—If the crop of clover be good, the succeeding oat-crop never fails.

6th. *Peas.*—The common grey is the kind used, sown broad-cast at the rate of about four busbels to the acre. Peas are preferred to beans, because they do not require to be so early sown; and they are ready to be cut sooner in the autumn; they are besides more easily secured. It is desirable that they should be drilled, for the sake of getting the ground kept

free from weeds, though in many seasons the horse-hoeing of them would be impracticable.

7th *Oats after Peas with Dung.*—If the pea crop has been luxuriant, the oats that follow are so also. The ground gets two ploughings, by the last of which the dung is covered in. Three ploughings would be better, if they could be overtaken, but it is seldom possible to get two performed with the ground in the requisite state in point of dryness.

8th. *Hay.*—It is allowed to lie in the swath till ready to rake, and to be put up into small cocks, which in fine weather may be the second day after cutting. In these it remains for a few days more, and is then put into small ricks of from fifty to eighty stones of twenty-four pounds, and when sufficiently dry, is carried home and put up together in a permanent rick. In this way it is as little as possible exposed to the influence of either good or bad weather.

9th. *Pasture.*—The land here will not stand constant cropping, or continue productive, without considerable intervals of rest under pasture. If the pasture is to follow the wheat crop, the grass seeds are sown in spring, and an occasion ought to be taken, if it can be got, when the wheat may be well harrowed and rolled. The grasses, however, are found to succeed well without harrowing, if sown early. Upon half an acre it was once tried to sow the grass seeds with the wheat in autumn. The wheat crop was remarkably injured by this mode of proceeding, but the grasses seemed proportionally benefited, and probably the land was not more exhausted by the grasses ripening their seed, than it would have been by a full wheat crop. It has been recommended to sow grass without any grain crop along with it. In this climate and soil, it is impossible to bring the land into the requisite state of tilth and cleanness, without a fallow in the middle of summer; and, judging from the above experiment, it might not be unadvisable to sow wheat to the extent of half the usual quantity along with the grasses. The young grass plants would be materially protected by the wheat during the winter, and the whole might be either pastured in the ensuing spring, or made into hay at a later period.

If the pasture is to follow the oat crop with dung, when the oats have been sown and the land harrowed, the grass seeds are sown and the field rolled. If the land be not fine enough, it is rolled and harrowed previously to sowing the grass-seeds, and then rolled again. The sowing down is an important operation, for under good pasture land improves much; but if the pasture be poor, it improves not at all.

The only grass sown in this district is perennial rye grass, the very worst for pasture, as cattle reject its shot stalks, which impoverish the land by ripening much seed. It would be a great improvement to sow along with it some of the grasses natural to the soil. Many of those that are the most abundant produce a great deal of seed, and every farmer might at little cost supply himself with them from his farm. By this means a better turf would be had from the commencement, while, by the ordinary process, a considerable time is lost, and the ground in a great measure occupied by more worthless plants, before these grasses make their appearance. Unless the land be in good condition, and unless there be shelter, it is needless to sow the more valuable species of grasses. Those sown on this farm besides rye grass, the clovers, and rib grass (plantago media), are timothy, and cocksfoot, of which the seeds are raised on the farm. The rough stalked *poa* (poa trivialis) has also been sown, and increased much the bulk of the crop of hay, but it immediately becomes dwarfish. Besides requiring shelter like the cocksfoot, it must have a deep soil. It produces seed abundantly. The timothy seems to be a very hardy plant and very perma-

nent, and no grass produces more seed. It is a great omission not to raise and sow the varieties of the fiorin also, for though fiorin immediately rises spontaneously, it is one of the best pasture grasses that are here indigenous. White clover is luxuriant for two or three years, but after that it, generally speaking, disappears. Sheep are fond of rib grass, and it puts out its foliage very early in spring, but cattle seem little disposed to eat it, and as it is always shot before they can be admitted to pasture, it is rather injurious where they are the only stock.

From the wetness of the climate and the large proportion of clay in the soil, it is not in general advisable to pasture grass land the first year: if done, it must at least be with sheep alone. In a dry season, there is no doubt that to stock early with sheep is most conducive to the fertility of the pasture, and the future improvement of the land, but, upon the whole, the safest plan for the first year, is to use the scythe. In such a season as the present (summer 1830), cattle do immense injury on pasture of even two or three years standing, and care is taken not to admit them, if possible, to fields recently laid down, except in dry weather. A considerable number of dairy cattle are kept on this farm, but for these and other reasons, it is thought that sheep ought to be its prevailing stock. From every consideration overstocking is avoided. It is a most short-sighted error too commonly fallen into. If eaten bare on such land as this in the early part of the season, the pasture never again recovers. After the commencement of autumn the grass grows very little, and if there be not then a full bite on the fields, the cattle, especially milch cows, will go to the fodder in bad condition; it will be impossible to keep them in health through the winter, and when again turned out to pasture, a great loss will be sustained before they come into a productive state. Under heavy stocking too, the pasture on land so ungenial never improves, and the soil consequently receives no amelioration.

DRAINING.

As a means of improvement, draining is the most important, the most permanent, and that which ought to precede every other. The drainage hitherto accomplished here, has been chiefly applied to carrying off water rising from the subsoil or springs. The most effectual amelioration, however, which land such as this farm consists of, can receive, is from what has been called furrow or surface draining. The greatest defect of this soil is occasioned by its shallowness, and the retentive nature of the subsoil, in consequence of which, the water falling on the land has not a sufficiently rapid vent. These drains are cut into the subsoil, so as to deliver the water as it approaches its surface. The distance at which they are placed must depend on the soil's depth, and the degree of facility with which water can pass through it, a drain doing more execution in a porous and deep soil, than in the reverse. Here from twelve to eighteen feet seems a sufficient distance. Though it has not hitherto been possible to accomplish much of this kind of draining, yet as all the drains that have been made, have been finished in such a way as to act also as surface drains, there has been sufficient experience to warrant submitting a description of them.

If the soil be of eighteen inches depth, six inches taken out of the impervious subsoil affords sufficient security for a drain; but however shallow may be the soil, the bottom of the drain should, at the very least, be twenty inches below the surface, for less will not admit a sufficient depth of stones to render the exit of the water for ever certain. The trenches are opened

a foot wide at the surface, and diminish in width towards the bottom. If the clay forming the subsoil be solid, the trench in it is thrown out with a wedge shaped spade, whose point is three inches broad, and this effects a saving of stones, bnt in other cases it is safer to have the bottom seven or eight inches wide. In opening the trench the soil is laid down nearest to it, and the clay thrown furthest off, *so that no part of it may be returned.* The next operation is the filling up of these trenches. The rubbish of a freestone quarry within the farm is the material used. When the bottom of the trench is soft it is flagged with thin stones, and if the quantity of water to run in it is considerable, a conduit is made with side stones and covers, otherwise the stones are thrown in without placing, beginning with the largest, none of which are the size of a man's fist, and finishing with the smaller, which are freed from sand by being thrown into a riddle. When brought within ten inches of the surface at the furrows, the upper part of the stones is consolidated and closed together by means of a hammer. It often happens that there are not ten inches of soil at the furrows, in which case the trench is further filled up with the sand extracted from the small stones, and as a plough passing through this can in no way injure the drain, it may safely, if requisite, be carried up to the very surface. Constructed in this way, it is not easy to conceive how a drain should ever become inoperative.

It is obvious that, by this mode of draining, the defect arising from a retentive subsoil, may be most completely remedied; to obviate the evil of shallowness of soil would require, in addition, trenching to the depth of ten or twelve inches. The expense of the operation must in every situation vary with the distance of the materials and the facility of obtaining them Here the drainage of an acre of land may be completed, according to the distance from the quarry and other circumstances, at the rate of from 4*l.* to 6*l.*, an outlay very trifling, when compared with the extent and permanence of the benefit derived from it. On the estates in this county belonging to his Grace the Duke of Portland, surface draining has for several years been carried on to a great extent. These drains are constructed with single arched tiles, upon which the soil is returned and the subsoil is scattered on the surface. It is considered that by this means his Grace has accomplished a very profitable amelioration. Except in very rare cases, the drain made with tiles is less expensive than that made with stones, and where the soil is easily permeable by water, the one may answer as well as the other; but where the soil is tenacious, one would suppose that the access to the conduit formed by the tile must be difficult. In any kind of soil, however, it is not possible that a drain formed in this way can be as efficacious, as one done as above described with the freestone rubbish, where an open pervious mass may be brought up if necessary to the very surface*.

MANURE.

Of this, almost the only source here is the farm-yard, and, considering its value, and how much that value depends on its treatment, it does not yet receive all the attention it deserves. On a farm of this extent, on which there has never in one year been above three acres of turnips and four of potatoes, it is perhaps a good deal to have manured eighteen acres in a season, from the farm-yard and the servants' cottages, and yet there is no doubt a great deal more might have been accomplished, as respects

* It is to be feared that the draining done by the Duke of Portland, in Ayrshire, and executing by his Grace in Northumberland, will, in a few years, be entirely useless, owing to no stones being put in the drains over the tiles.

both quantity and quality. If exposed to rain, the most soluble and richest parts are carried off. Observe the luxuriant vegetation wherever the dark liquor from a dunghill touches, and the loss may be estimated. If allowed to come into a strong heat, its substance may be seen passing into the air. The only part of it that requires rotting or fermentation, to render it soluble and fit to become food for the roots of plants, is the woody fibre of vegetables; the slower, however, and more confined the manner in which this process goes on, there will be the less loss. Some practical farmers have advocated the use of dung in its recent state, others have said it should not be used till well rotted. But if in the process of rotting it palpably undergoes waste, the place in which it must with most advantage be rotted, is under the soil of the field. There is then no loss that can be avoided. The fallacy in this controversy arises, it is suspected, from not adverting to the circumstance, that equal bulks of recent and of rotted dung contain very different quantities of the food of plants. In the latter it is more concentrated, and in a state fitter to be immediately consumed by their roots. But the correct way of stating the question is this: having a given quantity of recent dung to apply to a given extent of land, is it not better to plough it down in its recent state, than previously to allow it to ferment and rot in heap? In the first case, there is no loss; the decomposition goes on as slowly as possible, and all the elements of the substances of which it is composed are retained in the soil as they are set free. In the second, the decomposition is rapid, and a much larger proportion of matter will be found to have flown off than could easily be imagined. Any person without the aid of knowledge of chemical principles may satisfy himself on the point by an easy experiment. Take two acres of ground of equal quality: take twenty tons of recent dung, which apply to one of them: take twenty tons of the same dung and put it up in heap till it become a black solid mass, and then apply it to the other acre, balance the produce of the one against the produce of the other, at the end of the fourth year, and if the experiment be well conducted the result ought to be satisfactory. A knowledge of chemical principles leads to the inference, that dung ought to be used in its recent state, and any disappointment which, in practice, may have attended the adoption of this inference, will be found to have arisen, not from a defect in the theory, but from a want of due observation of circumstances in its application. If immediate effect be absolutely requisite, as in raising turnips, then rotted dung must be used, but care should be taken in preparing it, to prevent its heat from rising high or any of it from escaping, either in a liquid or in a gaseous state. This is best accomplished by compression and by covering well up with earth.

To increase the manure raised on the farm is a constant aim. A large portion of the straw is consumed by the cattle and horses, and no hay is ever sold. A considerable quantity of vegetable matter is collected from plantations and waste places, and with this, and the refuse straw, the farm-court and the approaches to it are kept littered so as to collect the droppings from the cattle and horses. The whole is occasionally carried off to the dung heap, and new litter applied. It is surprising how much dung may be produced by constantly collecting all refuse, which, if allowed to lie, would soon disappear. The horses are never allowed to pasture; from the 1st of June to the end of October, they are fed in the house on green food, consisting of red clover, rye-grass, and vetches. The calves that are reared are also fed in the same way in a yard, and in the course of the pasturing season, convert a great deal of vegetable matter into excellent manure. There are always, too, at this season, a few pigs fed entirely on

whey; and by these means much dung is made even in summer. There is no danger of dung made by animals in yards overheating in the warmest season, but without considerable precaution stable litter will then be very soon consumed away. For the purpose of preventing its rapid fermentation, peat moss was for some years used and regularly mixed with it in layers; but earth of any kind, or road-scrapings, will be found to effect the purpose, and in winter the cleanings of the cow-houses answer the end. What is made in spring and summer is taken to the fields as it is needed, and in winter it is taken to the field as often as possible, put up into heaps over which the horses and carts pass, and then well covered over with earth.

Lime.—To bring the land here to its greatest fertility, lime is essential; and to use it in large doses, and at distant intervals, is thought to be the most advantageous way of applying it. From one hundred and sixty to two hundred Winchester bushels per acre, are considered about the proper quantity, though one half of that accords with the practice of this district, where it seems often to be applied as if it were a substitute for dung. In most vegetables a little lime is found; every good soil contains a small proportion of it. This proportion, if wanting, ought to be supplied; and it would seem to be more advantageous to supply it at once, than by degrees, and at intervals. Hot lime, indeed, tends strongly to promote the solubility of inert vegetable matter in the soil; but to produce a given effect, the smaller the quantity of this matter in the soil, the greater ought the dose of lime to be. The quantity of it entering into the plants themselves is so small, that it seems to be chiefly by its affinities for water and for the other constituents of the soil, that it influences vegetation. It has been often observed in fallowing this clayey soil, that in wet weather, where a dose of lime has been just given, the land continues more friable, and is less apt to bind up on the recurrence of drought, than the rest of the field of similar quality. The grain growing on the well limed ground preserves its healthy appearance in wet seasons, while that growing on land that has not been limed is yellow and sickly. Wherever lime is laid upon pasture, the herbage assumes a more healthy colour; and though coarse before, is immediately eaten closely down by cattle. This is the case, though it be applied in a very moderate dose, and it is so to a much greater degree than would happen were manure in the shape of well rotted dung applied in far larger quantities than the inert vegetable matter in the sward can be supposed to afford through the action of the lime. For top-dressing pasture, the best mode of applying it is in compound with earth. Sometimes the full dose has been laid upon the sward a year previously to being broken up, but it seems preferable to apply it in its caustic state, while the ground is under fallow, when it can be most intimately mixed with the soil. The lime-stone is imported from Ireland, and burned on the spot in kilns made of turf. When ready to spread upon the land, its cost, including the cartage of the stone, and all other charges, amounts to about eightpence a bushel.

THE SECURING AND MANUFACTURING OF THE CROPS.

The result of the experience of this farm is decidedly, that all grain, but especially wheat, should be cut without regard to its colour or the greenness of the straw, as soon as milky juice can no longer be seen on bruising the pickle with the fingers. The extent of the loss sustained by the reaping of wheat being delayed for eight or ten days beyond this period, is very great. The best of the grain falls off in handling, and the sample

is not so fair as that of grain cut even before the milkiness is quite absorbed. The wheat when cut is set up in shocks or stacks of eight or ten sheaves, covered with a couple of hoodsheaves, and if this operation be well performed, it will stand a week's rain without injury. In this precarious climate, oats ought always to be hoodsheaved too. Peas are not sheaved, but left loose, and frequently turned. If the grain be in a doubtful state, care is taken to make the stacks small. A considerable part of the crop is stacked on frames supported by pillars with coping stones, and the whole ought to be preserved in this manner. Vermin are thus excluded, and the air circulates beneath the stack, and to any extent may be conducted through it by vents. The mode of stacking peas, chiefly adopted, is to build them round a high square or triangular frame, to which the air is freely admitted.

The crop is thrashed by a mill driven with great ease by three horses. In general, as much straw is thrashed each morning as serves the cattle for the consumption of the day. No oats are sold; they are converted into meal for the sake of getting the dust and shelling, which are found very useful in feeding the horses.

THE LIVE STOCK AND ITS MANAGEMENT.

1. *Horses.*—Moderate sized, active horses are used. An effort is made to feed them as long as possible on green food, as the most economical, and as most conducive to the increase of manure. The means employed, are clover and rye grass assisted by vetches. While on this food, and at ordinary farm work, they get no oats. When the green food fails, about the end of October, hay is first substituted, and, as the days shorten, oat or pea-straw. They now get each two feeds of oats in the day, or one fifth of an imperial bushel. In cleaning the oats, the weaker are separated for the use of the horses. These are again put through the fanners, or winnowing machine, and the refuse is used in making boiled food for them. Before breakfast, a boiler is filled with oat or wheat chaff, or cut-hay, mixed with a little of the refuse oats, or a little refuse wheat, or a few peas, or a few potatoes, certainly not equivalent in nutriment to half a feed of oats to each horse. At dinner time the contents of the boiler are emptied into a cooler, and mixed with some of the oat dust mentioned above, and of this, each horse, when his day's work is over, gets about a pail and a half. They get a great deal more fodder than is necessary, having always placed before them as much as they can destroy. It is conceived that sixteen or eighteen pounds of good hay would be enough for each, but there is no innovation which the farm servants have resisted with more perseverance than this, and the horses are allowed at least a half more. They are very constantly and regularly worked nine hours a day, and are very seldom a day idle; on this regimen, they have been always healthy and in good condition. The state in which a horse is capable of the greatest exertion and speed, is not one most conducive to health, and for a horse employed in ordinary farm work, rich and concentrated food is not only unnecessary, but injurious. Green succulent vegetables are alone quite sufficient for him. When this cannot be had, and there are no turnips, boiled grain and chaff are, to a great extent, a substitute, and the food described as given in this shape, might, it is believed, be beneficially increased. This supposition is founded, in some degree, on the analogy of what has been observed in feeding milch cows and young cattle. When cows that are feeding on straw or hay, get boiled chaff, their bowels are immediately brought into a healthful state, and their condition instantly improved, and a very small quantity

of turnips, half a dozen even, a day, produces similar effects. These effects proceed not from the addition of nutriment supplied by the boiled chaff, or the turnips, but from the power which these give to the intestines to extract more nourishment from the fodder. It is not unlikely, that if all the oats the horses get were boiled with chaff, a smaller quantity would be sufficient.

2. *Sheep.*—The most profitable stock of this description that has been tried has been black-faced, or Cheviot lambs, purchased in the month of August, and sold to the butcher the following June and July. For the first two months of spring, however, the pasture is so exceedingly bare, that they were found very difficult to keep within the fences, and ewes are now substituted. They are purchased as soon as the grass is up, the lambs are sold as they become ready to kill, and the ewes are fit for the butcher by December.

3. *Cattle.*—These are entirely the Ayrshire dairy breed, and are both a dairy and a breeding stock *. From fifteen to eighteen is the number of cows kept, and six or seven grey calves are annually reared. The calves get from ten to twelve quarts of new milk a day for the first six weeks. By the time they are ten days old, they will eat a little, and are supplied with hay and grass. They are then gradually weaned by mixing the new milk with an increasing quantity of skimmed milk, or the whey of new-milk cheese. When two months old, they get whey alone, which is continued to them through the season. They are allowed to run loose in a yard with a shed, and are supplied with green food in cribs. When the green food is at an end, they get, with straw, as many turnips as can be afforded to them, generally, a small quantity. The second and third seasons, they are pastured, and in winter, get, with straw, a small portion of turnips, if they be to spare.

Experiments on the nutritive matter in the straw of different kinds of grain, similar to those conducted by Mr. Sinclair relative to the grasses, are very desirable. Horses and cattle seem to eat the straw of beans and peas as readily as hay; and the experience of this farm leads to the belief, that the straw of wheat possesses much nourishment. It is coarse and woody, indeed, but contains a great deal of saccharine matter; and if used with a very small addition of turnips, the cattle are found to thrive on it. Last season, there were fed here from the beginning of November to the middle of May, eight greys, rising three years old, five rising two, and five rising one. They had two acres of yellow turnips, a middling crop, and the oldest two lots had nothing besides but wheat straw. The largest proportion of the turnips was given to the youngest lot; for some time, the eldest two got scarcely any, and for six weeks previous to the grass, wheat-straw alone, without a turnip, was the food of these. They all grew well, and retained their condition, and no falling off on the part of the latter during the last six weeks was perceptible.

There is no reason to doubt that the mode described, of feeding during the first season, is preferable to pasturing. Besides the excellent dung produced, the animals arrive, under this treatment, at a much greater size. As they approach having calves, some of them are sold, the best being selected for the dairy, where they are milked for three or four years. They often have calves at two years old, and if they have previously attained sufficient size, and the feeding be afterwards good, a milch cow is thus

* An excellent account of this breed of cattle, and of the dairy system, will be found in a work published a few years ago by Mr. Ayton. The book is not at hand, but the title of it is believed to be " Ayton's Account of the Dairy Husbandry of the Counties of Lanark, Ayr, and Renfrew.".

obtained at very moderate cost, but otherwise, they will remain small, and probably not take the bull again the season after calving.

The Ayrshire cows are generally allowed to be the best that are known for the purposes of the dairy. In the end of autumn, when the nights become cold, they are kept in the house after sunset, and get a little fodder; and from the middle of November till the pasture be again ready for them, they are fed entirely in the house, and let out only in fine weather to get water. They are regularly curried, and kept as clean as possible. Having not a sufficient quantity of green crop to supply them with succulent food, the milk is put off them as quickly after they are taken from the grass as it can with safety. Those that are to calve late in spring, and are continuing to give a considerable quantity of milk, get a little extra feeding; the rest have straw alone. When the calving time approaches, they get chaff or cut hay boiled in a good deal of water, and enriched with a few potatoes, or a little pea-meal with hay to eat. In this way, they go to the grass, which happens in general about the middle of May, in as good condition as when they left it. No food is found to produce so much effect as pea-meal, and will be profitably bestowed at the ordinary price of the grain; and though given in very moderate quantity *. Till the beginning of June, they are seldom allowed to lie in the field during the night, but though they are protected as much as possible from cold, their houses are at all seasons kept well aired and cool.

The cows are milked twice a-day, and the produce converted chiefly into sweet milk cheese, that is cheese made of the entire milk as taken from the cow. In such a situation as this, as to climate and soil, it is probably impossible to make cheese having the fine flavour of that of Gloucester and Wilts, but for some years past the production of a rich, mild and palatable cheese has been attained. Any person desirous of knowing the details of the most approved mode of cheese-making, in this part of Scotland, is again referred to Mr. Ayton's work. It may be sufficient here to notice one or two peculiarities. The milk is not allowed to cool, but thickened as taken from the cow. If the milk be allowed to stand till the cream separates from it, the cream can never again be completely blended with it or retained in the curd when set, and the cheese is poorer, and this, without great care in the management, to a considerable extent. The bad qualities of cheese may be produced in a variety of ways, but there is a certain rankness of flavour which it is conceived is the effect of the pasture, at least it could be attributed to no other cause here. This has been uniformly overcome by throwing into the pail before each cow's milk is drawn into it, about the half-full of a tea spoon of saltpetre. On this subject, however, it is more easy to speak as to results, than to state precisely their causes. It would conduce much to perfecting the art of cheese-making, were a series of experiments completed for ascertaining the general principles on which depends the great variety in its products.

The average produce of each cow, exclusive of her dung, has been 6*l.* 17*s.* and the pasture allowed to each not less than three acres. The deductions are obvious, such as the dairy implements, the dairy-maids' wages during

* Take a bushel of chaff and eight or ten sound yellow or Swedish turnips, having the tops and tails carefully taken off, and boil them together four or five hours. Add as much water as will cause the hand to move easily through the mass. Squeeze down the turnips, and add three pounds of pea-meal. Give this to a cow in the morning, and the same in the evening, and as much sweet hay as she will eat up clean five times a day, and without much expense her butter will be as rich and of as fine a flavour as can be produced in winter. Should the peculiar flavour of the turnip be detected, which is not likely, a small quantity of saltpetre put to the cream will take it off.

the pasturing season, and interest of the value of the stock. From the way, however, in which the latter is managed, there is no deterioration of it, as, unless on the supposition of a constantly falling market, the cows should be of as much value when sold as when taken into the dairy. In a situation unfavourable for tillage, and especially on small farms, the dairy is certainly a profitable mode of husbandry. Its success depends on constant attention and minute care, and on a small farm it is managed by the farmer's wife and family, while the offal goes a great way towards their sustenance.

4. *Pigs.*—They are peculiarly valuable in connexion with the dairy. The breed is small, and they do not exceed fourteen or fifteen stones imperial weight at a year old, but they are very hardy and remarkably easily fed. During the cheese-making season, they get whey alone, on which food they become quite fat. In winter they have boiled potatoes. A breeding sow is kept. Her spring litter is disposed of. As many of her second litter are kept as are necessary for killing in winter and spring, and for the consumption of the whey of the ensuing season. Those intended for the latter purpose are allowed to have pigs about the beginning of July, when they are ten months old. The having pigs does not seem to affect their growth, and they are disposed of about the end of November. In this way the litters have more than redeemed the cost of rearing the mothers.

FENCES.

A considerable extent of new fences have been made, chiefly hedges. Having an unlimited command of freestone at hand, stone fences would have been both the most immediately useful, and, in the end, perhaps the cheapest, but they are not so handsome as hedges, and do not afford so much shelter. On a thin and adhesive soil, it is very difficult to rear and preserve quick fences. A mixture of beeches and thorns is what has been used, but from the experience had in attempting to fill up gaps in old hedges, crabs are recommended as decidedly superior to thorns for all tenacious poor soils, and in such soils beeches will make a fence and afford shelter where no other tree will. The plants were placed from ten to twelve inches asunder. This distance is quite close enough for the purpose of a fence; and it is obvious, that the more plants that are put into a given space, the less chance there is of their thriving, especially if the ground be unfavourable. In such a situation it is very material to avoid cutting them till they have gained some strength and size; and, unless where very luxuriant, they have not been brought into shape with the pruning knife till at least after three years old.

FARM ACCOUNTS.

A farmer cannot know with accuracy wherein the system pursued by him is judicious and profitable, and wherein defective, without keeping accurate accounts of his receipt and expenditure. Keeping accounts, however, is too generally neglected, though besides its economical usefulness, it would be found an additional source of interest in every operation. The account kept for this farm, though simple, is sufficiently comprehensive. It is balanced once a-year, so as to shew the amount of the annual return. There is an inventory with the value of the whole stock. The amount of this inventory is the first entry on the debtor's side of the account, and it is followed by every item of expenditure during the year. The other side contains the receipts. When the account is to be closed, it is debited with

the debts due by the farm, and with a per centage on the capital invested in the different kinds of stock, and it is credited with the amount of the inventory of the whole stock, as then taken—including debts due to the farm. In making up the inventory, instead of valuing anew every article of the implements and working cattle, ten per cent. is deducted from the previous value, for deterioration, and at balancing five per cent. is charged on the capital invested in live stock, in seed, and in the produce on hand. If to know the returns and expenditure in any department be required, the information is easily taken from this account, and the balance, as applicable to each year, is sufficiently accurate for use. A form of the account will be given at the end. The only other that is kept is one for the barn. In this there is a place for each kind of grain—the grain thrashed is set down on one side, and the disposal of it on the other, and, when milled, the meal is entered separately in a similar way.

GENERAL CHARACTER OF THE DISTRICT AND OF ITS AGRICULTURAL OCCUPANTS.

The soil is, generally speaking, thin and tenacious, and of difficult cultivation. There are few large farms, and few of the tenants have any capital beyond what is invested in their stock. The pasture is universally occupied with dairy cattle. During the latter years of the last war, from the high price of grain, too great a proportion of the land was brought into cultivation; wheat was sown to a great extent with little manure, and the land reduced to a state from which it is, except in the vicinity of towns, extremely difficult to recover it. The tenants had afterwards to struggle between high rents and very reduced prices, which led still to a continuation of the evil, as well as to crippling their subsequent ability. The alteration in the value of money, and the distressed state of the other classes of the community, have also had their share in the difficulties of the tenants' conditions, and in the consequent injury to the land. Though landlords have, on the whole, adjusted rents as liberally as could be expected, the necessity for further abatement has been regularly progressive, and there is no reason to doubt that for seventeen years past rents have been too high. The effect of this state of things is, that if a tenant had capital, he lost it; he was unable to make the necessary outlays on his farm, and forced to scourge as far as he could. But the price of every item of agricultural produce seems now to have reached its lowest verge; and if the value of money do not increase further, and if the nation allow the land-owners to retain their monopoly, there is a prospect that rents will come to be properly and permanently adjusted; an ameliorating system of management pursued, and the soil brought to be as productive as its nature will permit. In the course of years, by less frequent cropping; by pasturing longer and stocking lightly, improvement may be accomplished. No hay should be sold, and no wheat sown where there is not an abundant command of manure. When a landlord can get a tenant of tolerable skill and integrity, it is bad policy to exact a burdensome rent from him. Farmers, especially those of little capital, are apt to offer too much for their farms: they can turn themselves to no other occupation, and are disposed more than any other class to be content with the smallest profits.

Peasantry.—The farm servants and labourers are in general in a situation of comfort. The annual wages of a married ploughman are from 12*l.* to 15*l.* in money, a house and garden, six or six and a half bolls of oatmeal of one hundred and forty pounds, and five bolls of 432 lbs. of potatoes,

The people who compose the agricultural population are of the best description. They are industrious and well-disposed, and as free from vice as consistent probably with the existing state of society. The instances of their requiring parochial aid are rare, and in the parish to which this farm belongs, the whole list of poor is made up of aged and infirm persons, and widows with young children. There is no poor-rate levied in this parish. The funds for the poor are derived from the collections at the church-doors, and from a small voluntary contribution by the proprietors of land. The population is about seven hundred; the number on the poor-list last year was ten, and the sum expended on the poor 42*l.* 10*s.* The situation of the whole district in this respect is understood to be similar.

FORM OF THE FARM ACCOUNT FOR ONE YEAR.

1829.	Dr.		1829.	Cr.	
Jan. 1st.	To stock at this date		Jan. 1st.	By debts of last year due by the farm	
	1st. Barn implements . .			(Here follow the entries of the receipts for the year.)	
	2d. Field do.		1830.		
	3d. Stable do., harness, &c.		Jan. 1st.	By value of stock at this date per inventory, including debts due to the farm	
	4th. Dairy do.				
	5th. Work horses . . .				
	6th. Live stock				
	7th. Debts of last year due to the farm				
	8th. Seed sown for ensuing crops				
	9th. Produce on hand . .				
	(Here follow the entries of expenditure for the year, which would include rent, if the farm were occupied by a tenant.)				
1830.					
Jan. 1st.	To debts due by the farm				
	To 5 per cent. on the value of live stock				
	To 5 per cent on value of seed				
	To 5 per cent. on value of produce on hand . . .				
	To balance being profit .				
		£			£

III.

NETHERBY, CUMBERLAND.

Management of the Home Farm.

The management of the Park of Netherby, the extent of which is upwards of twelve hundred and ninety statute acres, (independent of the woods surrounding and interspersed through the grounds,) comprehends the practical detail of a large grass and arable farm, managed on principles suited to the climate and local situation of the country, and occupied by the proprietor, not only with a view to the permanent improvement of the lands, but also to securing the largest return possible from them.

The detail is conducted by an active overseer or bailiff from one of the best-managed agricultural districts of Scotland.

The establishment consists of four regular ploughmen, each having the charge of a pair of horses; a steady elderly person, who has the charge of the granaries, and who superintends the field operations of hand-hoeing, reaping, &c.; and a park-keeper, who acts in the double capacity of superintendent of the whole grazing stock of cattle and sheep, and as butcher to the family. There is, besides, a person whose sole business it is to attend to the open and close draining of the lands about to be described, and whose services are of much consequence towards their good management. All these under servants have been very carefully selected. The female part of the establishment consists of a dairy-maid and an assistant in the cow-house. The establishment is so arranged that all hands are fully employed. All extra labour required at hay and corn harvest, and in hand-hoeing the various crops, &c. is very readily commanded from the adjoining market town of Longtown. Every account and payment incident to this establishment is kept by the overseer, and is regularly audited and settled by the agent once a month; and a copy of the monthly account is duly put into the proprietor's hands, who is thus enabled to have the real situation of his farming matters constantly under his eye.

Extra work, such as mowing, draining, &c. is let by contract to labourers.

DESCRIPTION.

The management about to be described extends, as already mentioned, over about twelve hundred and ninety acres. The soils are of various descriptions, and consist of the following general divisions:

1st. On the banks of the river Esk, which cuts the grounds into two portions, the soil is a loamy clay on a porous bottom, and very various in point of quality, as is generally the case with all lands whose formation is the deposit or washings down of lands situated at a higher level. These lands are under permanent pasture.

2d. A mossy soil of no great extent, but of considerable depth, incumbent on clay, now irrigated meadow land.

3d. Gravelly soil, on an open bottom of gravel, technically called a rusty gravel, held in pasture or alternate husbandry; and,

4th. A clay soil of various qualities on a close till or stubborn clay subsoil, unsuited to constant pasturage, and therefore kept in alternate husbandry.

The lands consist of about 480 acres loamy clay, $28\frac{1}{2}$ acres meadow, 320 acres gravel, and 462 acres clay soils.

The aspect is generally flat, but with a gentle undulating surface, and with a moderate inclination from the river which runs through the lands in a direction from N. E. to S. W. The whole lands lie compact and in a ring fence, and form together a very beautiful park, equal to any in the north of England, not only in point of appearance, but in real value, while these lands do not lie at more than from 70 to 120 feet above the level of the Solway Frith. The management of each kind of soil being different, requires a distinct and particular description, as will be found in the following account.

The Farm Buildings at Crofthead stand very nearly in the centre of the grounds, which has been found of great advantage in their management.

Longtown.—A considerable market town, containing from 1800 to 2000 souls, through which the great road from Edinburgh to London by Carlisle passes, is situated at the S. W. angle of these lands.

No manure can be procured here except what is produced on the farm, in the farm-yards at Crofthead, and what is purchased at Longtown. Of the last—as the farmers in the neighbourhood procure all they can—no great quantity of manure can be obtained. There is abundance of lime, however, to be got within four miles, at a price averaging about 3*s.* per single cart-load at the limekilns, or 4*d.* per imperial bushel. No chalk, clay, or shell marl is found in the neighbourhood, and the chief dependence is on dung and compost made on the lands, and lime as already stated. Turnips are indeed consumed on the lands, where the soil is dry, by sheep.

A trial is just now in progress of using bone dust, as a manure for the production of turnips; and if it succeeds, as is expected, this assistant will be much used here in future.

DRAINING.

The first operation of management has been *in every case* to ensure a complete under-drainage, to relieve the lands from the springs by which they were surcharged, as well as attending closely to open draining. The improvement of close draining has been most effectually done by tiles manufactured on the estate, at a distance of about three miles, and in the same manner as is practised in Staffordshire and Warwickshire, for a brief account of which see the Appendix. Many hundred roods of drains have been executed in this way, and with complete success. The open draining has also been a point of paramount consideration. The ditches, or main drains, have always invariably been cut out to the proper level, so as readily and freely to discharge the water delivered into them. The sides are carefully sloped back by the spade, so as to discharge the water from the ridges; and the earth so cut away, as well as all high head-ridges have been in every case most carefully mixed up with lime, repeatedly turned over at proper intervals, and, lastly, applied as a rich compost in top-dressing the adjoining lands, after being depastured for the first two or three years. It is very surprising that sloping in the sides of main drains, and open ditches, which is a means of providing an ample supply of rich manure in thousands of cases, is almost invariably neglected by the practical farmer; and that he should equally neglect to remove the high head-ridges existing in almost every field (occasioned by the repeated use of the plough), which would be the means of enriching the adjoining lands at an inconsiderable expense. This, with ditch and road scrapings, and every possible means of increasing the quantity of putres-

cent manure, have been closely and successfully attended to here, and with great success; and as the application of compost so collected has been almost in all cases to pasture lands, the effect has been excellent; while the grounds, when broken up for white crops, after being so manured, have—even on very inferior soils—yielded full and fair crops. Indeed the system pursued for a number of years, of turning every particle of soil not required for the production of useful crops, into compost to be applied as a top-dressing to the grass lands has been found very beneficial.

MANAGEMENT OF PASTURE LANDS.

The climate here, in common with the whole west coast of Britain, is rather wet; and considerable quantities of rain fall in Cumberland, in consequence of its proximity to the Atlantic. Dry soils therefore are of the greatest value here, and grass husbandry on many accounts is the most proper and natural for the district.

When lands are well and judiciously laid down to permanent pasture, the expense of their management is at once reduced. The local situation of this part of Cumberland, bordering on Scotland, renders it in a great measure a grazing or cattle-dealing country, and pasture land, of a good quality, is constantly in request, and yields full and fair rents, when let from year to year; or, when farmed in a run of seasons, it produces, either by cattle or sheep, a fair return to the grazier. The greatest part of the cattle and sheep sold in the great Scotch markets, in Galloway, and the north of Ireland, pass through this country to Carlisle, the great point where they change hands.

Old Grass Lands.—Around the house of Netherby a very considerable extent of old grass land exists. This has been completely under-drained; and as it was disposed to produce moss—so as to render the pasturage late in coming to maturity—a very heavy dose of *hot lime* was applied about ten years ago to the whole, with remarkably good effect; for after the first year's application, the moss was eradicated, and the pasture is now unrivalled in the country. The soil alluded to is generally good clay loam on an open bottom.

New Grass Lands.—Whether on light or heavy soils, it has been the constant custom here, in the first place, to lay the lands completely dry by under-draining; then to clean and pulverise the lands completely by summer fallow or green crops—to apply all the putrescent manure that could possibly be produced or purchased at a fair price. On light soils, turnips are consumed, by sheep folded on the grounds; and on clay soils, the turnips, if any are produced, have been regularly consumed in the farm-yards, and the manure so produced has been applied to the ensuing white crop. In all cases, supposing the lands (of whatever description of soil they may consist) to be thoroughly cleaned, the course here has been to sow out to permanent pasture with the *first* white crop, and with the following variety of pasture seeds; *viz.*

If Clay Lands,

Timothy Grass	Pleum pratense.
Pacey's Ryegrass	Solium perenne.
Red Clover	Trifolium pratense.
White Clover	Trifolium repens.

If Light Dry Soils,

Pacey's Ryegrass	Solium perenne.
Red Clover	Trifolium pratense.
White Clover	Trifolium repens.

Cocksfoot	Dactylis glomerata.
Rib Grass	Plantago lanceolata.

Hay *is never* taken from lands intended to remain in permanent pasture. These lands, whether heavy or light soils, are constantly depastured with sheep for the first season. If clay lands, the grass is depastured from 1st May to 11th November, and if light soil from 1st May to 1st March yearly; and no stock of any kind is admitted on either description of soil between the terms mentioned. The second year any ordinary description of stock is admitted. In the course of years it has been found necessary to break up some part of these lands, and to lay them down anew to permanent pasture: the following varieties of pasture seed are now sown and approved of here.

Clay Lands,

Timothy Grass	Pleum pratense.
Cocksfoot	Dactylis glomerata.
Meadow Fescue	Festuca pratensis.
Dog's-tail	Cynosurus cristatus.
Meadow Cat's-tail	Pleum pratenese.
Pacey's Perl. Ryegrass . .	Solium perenne.
Red Clover	Trifolium pratense.
White Clover	Trifolium repens.

Light Lands,

Timothy Grass	Pleum pratense.
Pacey's Perl. Ryegrass .	Solium perenne.
Cocksfoot	Dactylis glomerata.
Rib Grass	Plantago lanceolata.
Dog's-tail	Cynosurus cristatus.
Mixed Fescues	Festuca duriuscula, Festuca pratensis, &c.
Mixed Poas	Poa pratensis, Poa cerulea, &c.
Red Clover	Trifolinm pratense.
White Clover	Trifolium repens.

The inferior description of clay lands in particular have been much improved by opening the furrow every autumn, about the month of November, by means of the furrow draining plough—an implement of simple construction, but one that cannot be too well known by the agriculturist. Its object is to cut a furrow slice out of the already existing furrow, 6 or 7 inches deeper, while its mould board, formed of wood, throws this slice 8 or 9 inches clear out on the right-hand side of the plough—thus forming a complete (we may say almost invisible) drain—which lays the land dry, and which discharges all superfluous water through the ensuing winter, while the furrow slice so removed is an addition to the compost heap. This simple implement has been of the greatest use here, and is strongly recommended to all farmers of wet clay lands.

Double Digging or Trenching.—Last year, during the distress of the hand-loom weavers, a large extent of ground of a very stiff clayey nature was trenched by those out of employment, in order to employ them. The deepness trenched was eighteen inches, and the inequalities of the surface were regularly reduced and attended to, and the grounds planted with potatoe and mangel wurzel, properly drilled and manured. Next year wheat will be sown, and the ground laid down again to permanent pasture.

Irrigated Meadows.—Here there are 18½ acres of water meadow on the ridge or bed system, and about 10½ on what is termed catch-work.

It happens unfortunately that the water collected in a brook, descending through the lands to the Esk, is hardly sufficient, except in floods, for the purpose of complete irrigation. But the heavy crops produced even under imperfect watering, leave no doubt, however, of the utility of this branch of agriculture.

There are no other meadows here, and indeed the want of meadow ground is seriously felt over this district. In the general management of the pastures care is taken to eradicate docks, thistles, &c., from the surface; and moles are destroyed whenever their workings appear.

ROTATION OF CROPS.

The plough rotation followed on these lands has been as follows—on

GRAVELLY SOILS.

1. *Turnips.*—Generally Swedes or Aberdeen yellows, consumed on the ground by sheep.
2. *Barley.*—Sown about the middle of April with seeds for pasture: the lands laid generally quite *flat* in the surface.
3. Young Grass Seeds depastured by sheep; generally ewes and lambs, from 1st May to 1st March.
4. Pasture.
5. Ditto.—Top-dressed this season with compost.
6. Pasture.
7. Pasture.
8. Pasture.
9. Oats out of ley.

CLAY LANDS *of the best description.*

1. *Summer fallow,* or, if the season is suitable, Globe Turnips. In either case, the land thoroughly cleaned and manured. Turnips pulled and consumed in the yards by cattle.
2. *Wheat,* sown in autumn, and grass seeds for pasture sown in the succeeding spring: no stock of any kind allowed to depasture these seeds in the ensuing winter.
3. *Young pasture Seeds,* depastured by sheep from 1st May to 11th November; but unless the ensuing winter should happen to be particularly dry, no stock admitted after that period.
4. Pasture for the same period.
5. Ditto, ditto.—Top-dressed with lime or compost.
6. Ditto, ditto.
7. Ditto, ditto.

If the lands now begin to shew moss, so as to hurt the pastures, and render the grass later in coming to a full bite, they are generally ploughed for oats in the eighth year, about the middle of winter, so as to derive advantage from atmospherical influence, and are ploughed with a strong furrow.

CLAYS *of the second-rate description.*

1. *Bare fallow.*—Thoroughly cleaned, limed, and manured; the greatest pains being taken in all cases of clay land in the ploughing, so as to give the ridges a proper shape, to discharge all surface-water from the centre to the furrow.
2. *Wheat,* of the red kind, or oats, sown out with seeds for pasture.
3. *Seeds,* depastured by sheep from 1st May to 11th November.
4. Depastured by any kind of stock from ditto to ditto.

5. Depastured by any kind of stock from 1st May to 11th November.—Top dressed with lime or compost.
6. Ditto, ditto.
7. Ditto, ditto.
8. Oats out of ley.

These various courses of cropping have been found to suit the lands extremely well. The application of lime or compost to the third year's pasture, is a point never overlooked; for it is found to renovate the pasture grasses, and the grounds, after an interval of two or three years, break up in capital condition for oats.

Wheat.—The wheat sown on the best descriptions of soil is invariably the white kind. That most in request for seed is understood to be what is called, in East Lothian, "Hunter's Wheat." Wheat, after summer fallow, has always been found of the best quality and greatest weight to the acre: on inferior clays red wheat is often sown. This variety is certainly well suited to such soils, and often fair average crops are obtained; but it is thicker in the husk, and therefore not so much in request with the corn-factors. The price in the market is generally one shilling per Carlisle bushel under the price of white wheat*.

Sowing.—The quantity of seed wheat to a statute acre sown broadcast, is from $2\frac{1}{2}$ to 3 imperial bushels. The usual return, in favourable seasons, may be about from 34 to 38 imperial bushels per acre.

Period of Sowing.—On summer fallows, wheat is sown about the second week of September; and if wheat is tried after turnips, fed off on the lands by sheep, which is sometimes the case on lighter soils, the sowing being performed during the winter months in proportion as the turnips are consumed.

Tares or Vetches—Are seldom or never sown in this district. They answer, however, admirably in this district on fresh soils: they have invariably yielded a very large return of green food for soiling, and have been sown on purpose to be ready to be cut as green food between the first and second crops of clover. Tares are never made into hay in this district; and indeed from the great quantity of succulent matter they produce, in a variable climate, the process of making them into hay would be attended with much risk and probably little advantage. They are very useful when consumed in summer, in soiling by cattle or horses, and thereby adding greatly to the dunghill—a point of paramount importance, but in no other light is their culture recommended.

Rape.—Rape succeeds here very well on lands in fair condition. An experiment on rather a large scale was tried about eight years ago, of sowing in the month of July, no less a quantity than 120 acres of land of the first-rate quality—of loam intended for permanent pasture—with rape alone. The ground was previously thoroughly cleaned and limed, the rape and grass seeds sown, and the rape, immediately on arriving at maturity, eat off by sheep. The effect has answered, and the lands in question are the best pasture in the country at this moment.

Turnips.—The turnips sown here are the globe, the Aberdeen yellow, and the Swedish; all these varieties, when the seed is good and fresh, and the proper culture followed, have invariably succeeded here. The globe is consumed first, then the Aberdeen yellow, and lastly the Swedes. A number of other turnip seeds have been tried, such as the tankard, the green round, &c.; but, from experience, the three kinds first named are decidedly preferred.

Drill Husbandry.—Turnips are always drilled here, and without a

* A Carlisle bushel is equal to 3 A imperial measure.

single case of failure. The turnip husbandry of East Lothian and Berwickshire is followed from first to last. The crops produced are generally heavy, sound, and good, even on the stiffest description of clays. These crops are either consumed in the farm-yards by cattle, or on the ground by sheep. In eating off turnips by sheep, the practice here has always been at first to confine the flock on an extent calculated to support them fully for one week, and to give them a fresh break once a week afterwards, allowing the flock the range over the first portions of ground allotted to them. Hay, in sheep-haicks or cribs, is given along with turnips: Swedes are undoubtedly a most valuable crop to the farmer, and are the favourite food of all sorts of cattle and sheep. It is the custom in this establishment also to give the working horses, in the winter and spring months, a considerable proportion of Swedes daily; and the effect is to make the animals eat their oats with more avidity, and to render them more fresh, and their coats more glossy. No other crops (potatoes, beans, and mangel wurzel excepted) are drilled here. On the light soils, however, there is not the least doubt that all the white crops may be drilled and hand-hoed with the greatest advantage; and it is in contemplation to resort to this mode of culture in future, as the most garden-like management, and as yielding a heavier and better description of grain, while at the same time all annual and other weeds are destroyed. Swedish turnips are sown in the latter end of April or beginning of May; globe and Aberdeen yellows during the first and second weeks of June. It is proper to mention, that the sheep generally fed off by turnips are the best description of Cheviot wedders from Sutherland, Roxburgh, and Dumfrieshire. Ewes and lambs on turnip are seldom or ever attempted here. It would be reckoned very slovenly management to allow turnips to sprout in spring: they are always consumed when perfectly sound in the bulb, whether in the yards or in the fields.

Barley.—Barley succeeds turnips which were consumed on the ground by sheep: of course these crops can only follow with advantage in rotation on turnip soils. If the turnips have been properly managed, as already described by the eating them on the ground, the lightest soils will be compactly beat together by the treading of the flock. One furrow on such soils is considered in general sufficient, and the proper time of sowing is from 1st April to 20th May. It is here proper to state, that barley after turnip should be sown *hot furrow*, that is to say, the sower should immediately follow the plough, and the harrow the sower; and probably, if the weather appears to set in droughty, the grass seeds and roller should close the scene behind the harrows. When the process of barley sowing is conducted in this way, a failure of crops has never taken place here. Pure barley alone is sown; and the old variety, called rough beer or big, seems, with much propriety, to be quite out of fashion in the district. These grounds seldom fail to produce barley of an excellent malting quality; indeed, the vale of the Esk is celebrated for the good quality of its barley crops.

Grass.—Grass never fails to succeed here after barley. If it is intended to cut the grass crop green for soiling, ryegrass, with a large proportion of red clover, and a small proportion of white, are sown. The soils here, from the management described, are generally fresh; and not one single case is remembered where the clover crops have failed altogether on any of these soils.

Ryegrass—As a hay grass, is a very valuable variety; but when land is intended for permanent pasture, or for lying a number of years, ryegrass does not appear to be so well adapted as many other varieties

for grazing purposes, and hitherto too much seed of this kind has been sown here on permanent pasture lands.

Fiorin Grass has never been cultivated here. It is probable, however, that practical agriculturists may, in many cases, entertain unfounded prejudices against this grass. A small fiorin meadow, as a trial, is in the progress of being laid out at present.

Sainfoin is never sown in this district, and clover is seldom or never sown without a mixture of grass seeds along with it. One experiment, on good land, of sowing red clover only, succeeded admirably.

Potatoes, under good management by the drill system, never fail here, even on the clay soils. No great quantity, however, is ever grown on this farm, except for the use of the family.

Mangel Wurzel has been cultivated for two or three years. The growing of this esculent is, however, quite new in the district, and is therefore only cautiously attempted at first. The result, hitherto, is favourable, although the Swedish turnip is supposed to be a crop of equal value.

STOCK.

As feeding cattle for the butcher has always formed a principal point in the management of these lands, it is considered a matter of importance to select the breeds likely to arrive soonest at maturity. The pure short-horned breed, selected with care and expense from the stocks of the Messrs. Collins and other celebrated breeders, have long been used here, and on the best description of soils, with success. Various crosses have also been often tried between the short-horned and other breeds, and the result in general has been favourable for the first cross. The second cross produces here by no means so good an animal as the first. The cross between the short-horned and highland breeds produces a very good animal, with every tendency to feed, but of a nature almost as wild and untameable (and sometimes more so) as its highland progenitors. The cross between the short-horned and Ayrshire breeds produces a very good animal, generally well suited for dairy purposes. The cross between the short-horned and polled Galloway breed produces a very excellent animal, possessing, in a great measure, the feeding qualities and best points of the short-horn, and the hardiness, and docility of the Galloway cattle. On good lands, this cross is here preferred to any other stock. The pure short-horned cattle are found, after many years experience, to be rather too tender for the climate, and difficult and expensive to winter.

Galloway Cattle are the general stock of the district. They possess many advantages, as they can at any time be brought to market. Their hardy and very healthy habits fit them well for the climate and soils of Cumberland; and although the first cross with the short horn does produce a good beast, no good breeder would choose to continue his stock from these crosses. Thirty of the best West Highland heifers, and fourscore aged Highland black-faced wedders for the family use, along with the Galloway cattle, form the permanent stock on these lands. But from their extent it is impossible to winter as many cattle, as the grounds can summer; and therefore in April and May yearly, a flying stock of cattle, chiefly Galloways and West Highland heifers, are purchased in the local markets on their journey southward, and fed off on these pastures; and it is the custom to have an annual public sale of this flying stock. They are sold in lots, and are generally bought by cattle dealers and butchers. The greatest number are resold again at the great fair of

Broughhill in Westmoreland, on the 1st of October. Thus the pastures are completely eased at the proper season, and left rough for the wintering stock, and about this period all accounts are settled, the remaining stocks, crops, &c., valued, and the profits or loss on the whole concern annually struck.

Sheep.—Except the black-faced stock already mentioned, as kept for the consumption of the family, no other sheep are kept, for it has been found that cattle pay much better; pure Leicester and South Downs have been kept as breeding stocks, as well as Cheviot and half-bred sheep, but the result has been to abandon a breeding stock of sheep entirely.

Lambs.—The breeding of lambs for sale to the butcher has never been followed here, but breeding for a stock has been. The ewes have in every case lambed in the open pastures, and little or no loss has ever ensued from the practice.

In extensive stocks, it is impossible to protect the ewes in the lambing season, from the fall of rain or snow. In very small stocks, sheds for sheep may answer a very good purpose, but it has never been found necessary to provide such protection here. Folding ewes in a confined place in the lambing season, is decidedly an improper mode, and is never practised in this country.

The sheep commonly grazed in the district are the Cheviot breed, but probably the most profitable is the half-bred or cross, between the pure Leicester, and the pure Cheviot; for these possess the stamina or hardy constitution of the Cheviot, with the docile and gentle nature and feeding qualities of the Leicester breed, while the wool is improved by the cross. Sheep are seldom laid with tar and butter on these grounds, but otherwise everything that can conduce to their health and comfort is attended to by a careful person who manages the stock.

Horses.—The farm horses in greatest repute in this district are the rough-legged Clydesdale or Lanarkshire breed. In this establishment, these and the Cleveland horses are generally used. The preference in the reporter's opinion is due to the Cleveland breed, for they are more quick in their movements, and consequently better adapted to light soils than the Clydesdale, which breed, however, is admirably adapted to heavy soils, and are remarkably quiet, and generally possess good constitutions.

Pigs.—This particular district produces great quantities of bacon and hams for the London and Liverpool markets, and the breed of pigs is in consequence a point much attended to. There are different breeds here, but the kind preferred in this establishment is what are provincially called the 'prick ears,' a well made, short-legged animal of its kind, of a yellowish-white colour, averaging, when quite fat, sixteen or seventeen stone of fourteen pounds each. This variety seems of a remarkably sound constitution, and is generally fed off at from twelve to fifteen months old. In this district pigs are allowed a range of pasture, with food in their piggery at regular intervals, and they thrive remarkably when so managed. On this farm, however, they are only allowed the range of the straw-yards. They consume the refuse from the kitchen, aided by potatoes, &c., steamed for their use, and they have always yielded a very fair return.

Management.—Cleanliness, as well in making ready the food as in the piggery, is essentially necessary to promote the health of the animal, and fresh beds of clean straw are regularly given them. A steaming apparatus on the most approved principles for preparing the food of the horses, dairy cows and pigs, has always been used here, and ought to be used on every large farm, but attention should be paid not to give any food more than lukewarm to any stock.

IMPLEMENTS.

Ploughs.—Iron ploughs only are used. The first of the kind was manufactured by Wilkie, of Uddingstone, near Glasgow, but these implements are now regularly made on the best construction, by tradesmen in the neighbourhood. They are uniformly drawn by two horses abreast only, and with such ploughs and horses, any kind of soil may be well cultivated. The furrow-cutting plough described under the head of grass husbandry, may be made by any plough-wright, and is a most useful implement. The number of horses employed in drawing it depends on the depth of the furrow, and the nature of the soil.

Carts.—Carts with iron axles and two shafts, as commonly used in Lanarkshire, drawn by a single horse, are decidedly the best, and no other kind is used here. In harvest and haymaking a frame is mounted on the shelvings of such carts for bringing the crops from the fields.

Harrows.—Finlayson's patent harrow is greatly used here for cleaning lands. It is a very useful and excellent implement for such purposes. The common seed harrows are in use on this farm; some of these are made of iron.

Drill Machines.—A machine for sowing turnip by two drills at once is used here, and another machine mounted on a small wheel, and pushed by a man, for sowing grass and clover seeds, is also in use.

Threshing and cleaning the Grain.—At first for many years this was done by a threshing machine driven by horses—latterly it is altogether done by hand labour and by the flail, and paid for by the bushel of cleaned grain. The expense is probably as cheap by the flail as by the machine, and employment is thus given to the poor, and every purpose required is answered by the present practice*.

MANURE.

No part of rural economy is less understood or attended to than the management of manure, and it would require a treatise on the subject to detail the systems pursued in the best farmed Scotch districts, which are always held as the guide for good management here. It may be shortly stated that all the urine from the stables, yards, cow-houses, piggeries, &c., is carefully conducted by under drains into the dung-pits. The dung collected is carted out during the winter for turnips, and laid up in convenient places for a speedy application to the lands, the instant the season suits for sowing. The middens, or dung-hills, in the fields are hollowed out in the bottoms, so as to prevent the moisture from escaping, and are regularly covered with mould. The carts are never allowed to pass along the dung-heaps. The manure made in summer when cattle get green food in the house is always of better quality than winter-made dung, and is generally applied to the summer fallows. Short dung is unquestionably most suitable for turnips, as in that state it affords no interruption to the plough and drill. Long dung, that is to say, dung not fermented, may be applied to potatoes without any impropriety. The management of compost occupies considerable attention; frequent turnings, and probably twelve months are required to reduce the stubborn lumps of clay often used in the making compost, and turnips are in many cases raised by no other application.

* The experience of every other district of the kingdom is contrary to this conclusion. The machine threshes much more cleanly, and it is equally beneficial to the consumer and the farmer, from the facility with which it enables the latter to meet all the changes and exigencies of the market.

GENERAL CHARACTER OF THE DISTRICT.

The estate, of which the lands here described form a part, consists of an extensive district, in which there is a very considerable quantity of good loamy clay and gravelly soils on the rivers, but by far the greatest portion is clay soil. Horses are regularly bred by almost every farmer, and the dairy husbandry (chiefly in the making of butter) is largely followed. Every person produces a certain number of young cattle as well as fat beasts for market, and large quantities of pork and bacon are produced, besides considerable quantities of wheat, barley, oats and turnips. In this district, where a mixed system of husbandry is followed, from the necessity of attending markets, and from having a considerable intercourse with strangers, the farmers are sharp clear-sighted people, alive and ready to adopt any successful experiment, *after it has succeeded under the proprietor's management.* On this estate a local farmer society, confined to its bounds, but having three hundred members, has long existed, by whom prizes are yearly awarded to every branch of good management in agricultural matters, and to the various descriptions of stock. The yeomanry thus meet regularly once a year, they hear the management of their farms discussed openly and freely; good managers are praised and rewarded, and indolence and bad management would be ashamed to exhibit themselves. All the good stock of the country is annually shewn, and the spirit of emulation is invariably attended with good consequences at the next meeting.

The country is purely agricultural. No man is above his profession, and almost all are possessed of means fully equal to managing their lands in the best style. The country is now enclosed and subdivided into suitably sized fields. Quick hedges of thorn, kept neatly dressed by the pruning knife, are the common fence of the country, and few countries can boast of better hedges than this.

Except along the sides of the great roads, hedge-row trees are not usually seen or planted, and the country where grain is chiefly produced has been purposely and judiciously left open, to admit a free current of air and sun to the crops, a point of much consequence in bad seasons, and in a climate as damp as this is. This district lies low. It extends from the head of the Solway Frith, rising from the level of the sea, with a very gentle general rise for twelve miles, to an altitude of about five or six hundred feet. The district is not subject to any epidemical disease. The people are temperate in their habits, and often attain a great age: pulmonary consumption, however, frequently makes its appearance, particularly in the vales descending towards this open country; and numbers of the youth of both sexes are cut off by this fatal malady.

PLANTING.

The management of plantations is probably foreign to the common operations of the farmer, but the shelter which they afford render them at all times, and especially in an open district, objects of great moment even to him. Hundreds of acres have been planted on this estate, and the general success has been cheering. Trenching by the spade has never been done here preparatory to planting timber, the scale on which planting has been conducted being far too large to be managed in this way, but the lands have in every case been laid dry by open drains, and in some cases (particularly in planting land covered with short ling) the ground has been ploughed before planting by a plough drawn by four horses. For the first three years, the young trees have not grown so luxu-

riantly as might be desired, but in the fourth year, and afterwards, they push out vigorously. In every case care has been taken to plant hard-wood trees of oak and ash, &c., and at such spaces that they may ultimately become the standard trees; and larch and Scotch fir are, in the meantime, planted as nurses, to be removed according to the necessity of the case. Every variety of tree thrives well on this property, but more particularly on the loamy soils.

CAPITAL AND ACCOUNTS.

Without an adequate capital, good farming cannot be followed. This, however, though a point of first consequence, we fear is often too little considered by the young farmer, and probably by the proprietor in letting his lands. Before letting lands, the proprietor or his agent should, if possible, be thoroughly acquainted with the farmer's means and capital, as well as his general habits and disposition; and if this is insisted on, it will prevent, in many cases, tenants of inadequate capital and bad character from obtaining leases.

Few, or almost no farmers, keep *regular* accounts, and the consequence is they are often in the dark as to the true state of their affairs. A system sufficiently simple and concise might be easily contrived to answer all the ends in view; but, from prejudice or want of habit, it is to be feared the general run of farmers dispense with the keeping regular accounts.

Labourers.—Labourers are easily obtained here, either for piece-work or by the day. Their wages by the day are generally 1s. 4d. to 1s. 6d. in summer, and 1s. 2d. to 1s. 4d. in winter. These men are bred from infancy to all kinds of agricultural labour, and are generally expert in the use of the spade, scythe, &c. The real good farming labourer here cannot, with justice, be said to be in distress, for he always finds employment; and in this district the labourer has advantages unusual in some other parts of the country. For instance, his fuel costs only his own labour in cutting and preparing the peat; he, in every case, keeps a pig, and sometimes two; and the manure, ashes, &c., his pigs and cottage produce, are readily laid on by the farmers on their fallows for the cottager, who receives one crop of potatoes from his own manure. The great evil is early marriages: young men generally marry before they are twenty, and the females much sooner, and the alarming extent to which bastardy has increased in the country is a most serious evil. No labourers in these parishes possess any little property, such as a cottage and garden of their own. The poor-rates have not increased here for eleven years past, and the county rates are rather less now than at that period. The farm labourers are generally well behaved, cheerful, and obliging; and it is very rare indeed that any of that class ever appear to solicit aid from the parish vestries.

POOR-LAWS.

The lands described are situated in two parishes. The management of the poor-rates is conducted in each parish by a select vestry, under Mr. Sturges Bourne's Act, the rector of the parish acting as chairman. The poor (chiefly the aged and infirm, and the hand-loom weavers of Longtown, and some small villages in the neighbourhood) have their various cases heard and relieved, and if ever there is an appeal from these vestries to the local magistracy, the case of the applicant is fairly and properly enquired into, and suitable relief afforded. Indeed, there is an evident wish among all parties to do what is fair and just to the poor. The presence of the clergyman in these vestries, however, has no doubt had a great influence in checking any thing improper on the part of the members of vestries.

Assistant Overseer.—Each parish has an assistant overseer, who, besides a regular salary, receives ten per cent. on all monies he may recover from the fathers of illegitimate children. This is a point of much consequence, for, from the local situation of the district, divided from Scotland by an ideal line, the fathers of such children, from either side of the border, easily escape from the maintenance of their progeny if they are so disposed. These overseers are thoroughly acquainted with their profession, are respectable in their way, have a perfect knowledge of the paupers, and are exceedingly usefol in keeping down the poor-rates, and seeing the fonds properly applied.

CHARACTER OF THE PEASANTRY.

As already remarked, the peasantry are generally civil and obliging in their dispositions, and grateful for the good treatment and kind words they may receive from their masters. It is a truth which constantly strikes the reporter's observation, that however illiterate they may be themselves, the peasants strain every nerve, and often deny themselves many little comforts, in order that their scanty funds may be saved to get their children decent education at the parish schools. It is no uncommon thing for labourers to continue in one master's employment many years, and on this farm of Netherby all the servants have been in their present service for a long period, although their engagements are only from week to week.

Parish Schools.—In these two parishes there are eight endowed schools, at which all the useful branches of common education are taught by schoolmasters appointed by the rector of the parishes: these schools deserve, and do receive every support from all classes of society here, and are indeed a blessing to the country. The many thriving and wealthy merchants and tradesmen of respectability, natives of this district, now settled in London and elsewhere, fully prove the good effects of edocating the lower orders, and the example of the good character and the enterprize of the young who leave the district, acts as a spor to push on those left at home to emulation and good conduct.

Means of improving the Condition of the Peasantry.—Ploughmen cannot be employed by the piece *, but a great portion of agricultural laboor may be so done. It has long been the practice on this farm to let every thing possible by the piece, as a matter of justice and propriety, both to the employer and his labourers. This is a most encouraging plan to the industrious peasant, who thus secures the fair retorn for his labour. Jobs are always let by estimate, but the competition, though fair, is never so very keen as to reduce the prices given too low.

Medical Aid.—The family surgeon attends the whole permanent servants of the establishment in cases of bad health, and he receives a regolar allowance for his services.

Gardens.—All the permanent servants have small gardens, well kept. These patches are a source of great comfort to the possessor, and a rational amusement at his leisure hours. A few of the ploughmen are allowed to keep a cow each, on paying a very moderate rent for the pasture through summer.

Separate dwellings.—The dwellings of the labourer ought undoubtedly to be separate from each other. This, however, unluckily, is not the case here, for all the permanent servants live under one roof in a large three-story building erected many years ago, near the farm-yard. These people are all respectable in their way, bot huddled together as they are,

* But for that reason are paid at a higher rate of wages than the ordinary day-labourer.

it is not possible to prevent little quarrels and bickerings from breaking out occasionally, where people with families (although each has two separate rooms) are so congregated. It is in contemplation to remedy this mistake, by erecting separate cottages for the servants.

Residence of the Proprietors.—In this district one great proprietor owns the whole, whose residence is constant.

Marriage.—There can be no reason why the labourer should not marry, except that they are too ready to enter into that state when very young, and before they have saved a little money to begin the world with; though, as yet, the excess of the agricultural population is not felt as a serious burden in this district, for the country is making rapid strides in improvement, and all good hands find at present ready employment.

Believing that details of real practice are of more use to the cause of rural improvement than theoretical opinions, unsupported by the test of experience, the reporter has confined his observations, as closely as possible, to giving an accurate account of the management of a gentleman's park and farm on a large scale; and he has only further to say, that the profits or returns have been always fair, and such as completely to warrant a continuation of the systems pursued.

Glinger Bank, Longtown,
19th July, 1830.

APPENDIX.

AN ACCOUNT OF UNDER DRAINING, BY MEANS OF TILES.

Until the year 1819, little close draining had ever been attempted on this estate, or in its near neighbourhood, on the English side of the Border. Indeed, the general want of stones for draining, and of quarries where materials might be procured at a moderate rate, contributed much to retard this primary improvement; for, excepting at one or two places on the Liddell and Lyne, where the old red sand-stone makes its appearance, no stone quarries existed, and even these were at such a distance from the general situation where draining was necessary, that the expense of carriage alone precluded all idea of ever effecting a complete drainage of a very extensive property by means of stone. It thus became a matter of grave consideration, how an extensive drainage was to be effected without the usual means of stones, except at an enormous expense; and the following plan was adopted. A proper person was brought from the neighbourhood of Tamworth, for the purpose of examining the estate of Netherby, to discover if proper clay could be found for making tiles; and his report, after a careful survey, having been favourable, a contract was entered into with him for the manufacture of draining tiles for the use of the estate. A proper tile-kiln, shed, &c, were erected, and the whole process was in active operation in the season of 1821*. The engagement with the Staffordshire tile burner lasted for three years; and was certainly attended with considerable expense. Care, however, had been taken to supply the tile-burner with natives of the estate, as assistants, who readily learned the art; so that at this moment upwards of two hundred and six thousand draining tiles are annually supplied by a native of Netherby; and the lineal extent of about forty miles is the average

* This mode of draining is the ordinary system pursued throughout this and the adjoining counties.

quantity of drains executed yearly on the estate, chiefly by the farmers themselves.

At the first beginning to drain with tiles, a certain degree of suspicion existed, even in the mind of the author of these sheets, that they might not fully answer the end in view; and, before entering into any engagement with the tenants, it was considered proper, in the first place, that trials on a large scale should be made by the landlord of the soils upon several farms at that time in his own hands.

The draining being successful, the farmers, encouraged by long terms in their farms, were bound in their new leases to drain ALL the wet lands of their various possessions, within a given number of years, on being allowed draining tiles *gratis* by the proprietor, and executing the draining to the satisfaction of the agent of the estate. Thus, in a few years, several thousand acres of otherwise unproductive soil have been rendered perfectly dry, and fit for every operation of husbandry; and the greatest improvement has in consequence taken place in the rural economy of the estate, and the condition and habits of its occupiers.

ACCOUNT OF THE MODE OF BURNING TILES, &c.

The clay most suitable for draining tiles is of the same description and quality commonly used for the coarser kinds of pottery purposes, such as the making of house tiles, jars, &c. The clay used at Netherby lies close to the surface or top soil; the bed is about five feet thick; it is what workmen call *keen* clay, and is quite free from small stones, or any mixture, or lime wash.

The clay necessary for the supply of the ensuing season is always turned over about the preceding Martinmas, in order that it may receive the benefit of the atmosphere through the winter. In the spring, as soon as the frosts are gone, the process of tempering commences, which is done with the greatest care, either by a simple grinding machine, driven by an ass or pony, or by manual labour. Moulding the various sizes of tiles, in which a small proportion of sharp river sand is necessary, then takes place. Four moulders are commonly employed, each attended by a stout boy, for bringing him the tempered clay in lumps, and removing the moulded tiles. The table on which the tiles are moulded is about four feet long and two feet broad, furnished with sand and water boxes. Two moulds are necessary for each tile; the first, a square (see Fig. 1.), contains the superficial tile before rounded; the second (Fig. 2.) is used for forming the tile into the proper shape. A clay-cutter is also necessary (Fig. 3.), the bow of which is a strong hoop bent, the string a piece of strong wire. Each description of tile requires its various moulds. The best shape of draining tiles is that represented by Fig. 4.

Fig. 1.

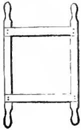


Fig. 2.

Fig. 3.

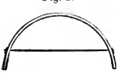


Fig. 4.

B A

The size is measured at the open of the bottom of the tile from A to B. An expert moulder will mould in a day either 1000 three-inch tiles; 900 four-inch tiles; 800 six-inch ditto; 300 eight-inch ditto; or from 2500 to 3000 building bricks.

The wages of a good moulder are from 3s. to 3s. 4d. per day in summer, and his assistant has generally 10d. or 1s. per day, without ale or victuals. The tiles are neatly and carefully arranged in layers, crossing each other, and divided by thin pieces of wood, in an open shed to dry, and when dried sufficiently, are consigned to the tile-kiln, and there properly arranged on end, for the purpose of being burnt. It is necessary to have a quantity of building bricks in each kiln, for the purpose of setting the flues. These bricks are moulded and dried in the usual way. The kiln contains about 9800 draining tiles of various kinds, and about 2000 bricks. Each kiln requires from 180 to 200 imperial bushels of coals to burn the whole. The burning process requires the most watchful attention day and night, so as to keep regular fires and heat in all parts of the kiln. The process of burning generally takes about three days, and two or three days more are requisite before drawing, in order to allow the kiln to cool. The tiles pay no duty to Government, and are not glazed.

The establishment for this manufacture consists of a kiln 21½ feet long by 15 feet wide over walls, and 11 feet high, with five furnaces on each side, sunk about four feet under the common level of the surrounding ground, open at both ends and top, and built of bricks. The walls diminish in thickness from 2 feet 9 inches at the bottom, to 18 inches thick at the top. There is a drying shed 135 feet long, and 20 feet wide, open all around for 4 feet high, supported on strong wooden posts, and covered with thatch; and around these erections are the floors for moulding, &c. Were it necessary to rebuild these erections, it is possible the construction and arrangement might be considerably improved, particularly in the kiln.

The agreement with the tile burner is this:—He gets a good cottage and garden rent free, and the use of tools, moulds, &c., belonging to the kiln; all which, together with the premises, he is bound to keep and leave in good order. He prepares the clay, provides the coal, and every thing else necessary, at his own expense; and furnishes the best made draining tiles and bricks at the following prices, which are in full of every thing whatever:—

	£.	s.	d.
Three-inch tiles per thousand	1	4	0
Four-inch do. do.	1	8	0
Six-inch do. do.	1	17	0
Eight-inch do. do.	3	0	0
Building bricks per thousand, Excise count, and the contractor paying the duty	0	19	0

The prices paid for tiles at the sale kilns of the neighbourhood of Carlisle and Wigtun, where they are now extensively used by many intelligent agriculturists of the first respectability, are generally as follows:—

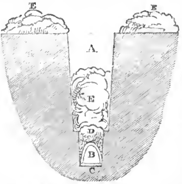
	£.	s.	d.
Three-inch tiles, per thousand	2	2	0
Four-inch do. do.	2	12	0
Six-inch do. do.	4	4	0
Eight-inch do. do.	8	8	0
(N.B.—These tiles are each 18 inches long.)			
Building bricks per thousand, Excise count	1	5	0

It will be seen from these statements, that the proprietor of Netherby is a gainer to a considerable amount, by manufacturing his own draining tiles.

CUTTING AND FINISHING THE DRAINS.

In laying out the lines of drains, where springs are intended to be cut off, the same system practised by scientific and experienced drainers, who use stone, is followed for draining by tile. Where the removal of surface water is the object in view, the natural inequalities or indentations in the surface are carefully examined, so as to attain the object with as few drains, and as great effect as possible. Where very stiff clay exists, a drain even in every furrow has been resorted to with much effect, but this has seldom been necessary on this estate, although the expense is not so great as may appear at first sight. In other cases, where the soil is of a damp, retentive nature, such as the poor clay and peaty soils mentioned, where the surface is very flat and incumbent on a stiff clay, and no springs existing, main drains have been run in the lowest parts of the land to be drained, and smaller drains run into these parallel to, and at stated distances from, each other. This mode, when properly executed, answers the purpose in view remarkably well.

The manual operation of draining has been conducted in the following manner:—The deepness has always been suited to the object in view; drains for springs in many cases have been very deep, so as to cut through the substratum containing the water, whether that has been gravel or sand, and surface draining from $2\frac{1}{2}$ to $4\frac{1}{2}$ feet deep. In all cases, the drains are cut as narrow as workmen can conveniently work in them, decreasing in width as they approach the bottom. The tools used are the common spade, shovel and pick, or the round-mouthed spades used in forming canals, &c., called here navigation spades: the last a most useful implement for cutting through stubborn clays. The drains being cut to the required depth, with *all the top soil laid on one side*, and all the subsoil thrown out on the other side, a narrow-mouthed spade (technically called a spit) corresponding to the breadth of the tile to be used, is then introduced, and with this instrument a bed for the course of the tile is carefully and neatly excavated, the strictest attention being paid to preserve a fair equality in the bottom, and a regular descent for the water; while a very frequent use of the spirit level is commonly necessary. The mode of draining will be more distinctly explained by the following sketch:—



A, the drain cut to any required depth; B, the space for the draining tile; C, a bit of slate or broken tile, on which the tiles rest at their joinings. This is sometimes omitted, where the bottom is a stiff clay. D, a clean-cut green turf, the grass side next the tile, and clapped carefully over it, to prevent the tile from receiving any damage. E E, the surface soil, cut out of the top of the drain, generally of a porous nature, put above the turf. The remainder of the drain is filled up, if wished, by the subsoil excavated, or what is more general, this soil is spread on the adjoining ridges, and the sides of the drains are then sloped in by the spade. Straw, furze, or small brushwood is sometimes placed next the

tiles, but a clean turf is preferable. It has been the practice in some cases at Netherby, when the drains happened to be very near the river, and carriage of course not expensive, immediately after the tiles are placed, to fill up the drain with the clean blue stones from the bed of the Esk, which are here very small, to as great a depth as it is thought necessary, and then to finish off the drain in the usual way of closing stone drains. This most decidedly makes the best of all drains; but with tiles alone, the result has been most gratifying, on all the varieties of soils mentioned, where the drains are carefully executed. It has been customary here to use the auger in cases where the tapping of springs was thought necessary.

EXPENSE OF TILE DRAINING.

The rate of labour in this quarter of Cumberland is moderate. The very best labourer, in summer, has from 1s. 8d. to 2s.; and in winter, from 1s. 4d. to 1s. 6d. per day, without victuals or ale. The cost of cutting, laying the tiles, and finishing drains here, is generally thus:—Drains 2½ to 4 feet deep, 4½d.; drains from 3 to 5½ feet deep, 6½d. per Cumberland rood of 7 yards, or 21 feet. The length of the 3, 4, and 6-inch tiles is, for each, one foot. The eight-inch tiles are 18 inches long; a single horse cart carries, with the greatest ease, 250 tiles of various sorts, or nearly 12 roods; so that from these data, and the expense of the tiles given at page 10, the real cost of draining by tiles may be accurately known. The following calculations may, however, help to elucidate this important part of the subject:—

I. Expense of Draining by Three-inch Tiles.

	Per Rood of 21 feet.		
	£.	s.	d.
Cutting the drain, say, on an average, 2 feet 9 inches deep, laying the tiles on slate or refuse tile, cutting and laying a turf over the tile, reversing the surface, soil, and covering in	0	0	4
Tiles, 21 to the rood, say at the price paid at Netherby for three-inch tiles, 24s. per 1000	0	0	6¼
Carriage of tiles, average distance 3 miles, 3 rakes of a horse and cart per day, a cart carrying 250, and at 5s. per day horse and cart	0	0	1¼
Refuse slate, or broken tile and carriage	0	0	0½
Per rood	£. 0	1	0½

II. Draining by Four-inch Tiles.

	Per Rood of 21 feet.		
	£.	s.	d.
Cutting, say 4½ to 5 feet deep, laying tile, and finishing same way as the last	0	0	6
Tiles, 21 to the rood, at 28s. per 1000	0	0	7¼
Carriage, same as the last	0	0	1¼
Refuse slate, &c., and carriage	0	0	0½
Per rood	£. 0	1	3¼

III. Draining by Six-inch Tiles.

	Per Rood of 21 feet.		
	£.	s.	d.
Cutting, say 4½ to five feet deep, laying tile, and finishing same way as two last cases	0	0	6
Tiles, 21 to the rood, at 37s. per 1000	0	0	9¼
Carriage	0	0	2
Refuse slate, &c., and carriage	0	0	0½
Per rood	£. 0	1	5¾

If, however, tiles are to be purchased from a common tile-kiln, where

they are made for public sale, the expense would be thus:—Drains by three-inch tiles, 1s. 4¾d. per rood; drains by four-inch tiles, 1s. 9½d. per rood; and drains by six-inch tiles, 2s. 6d. per rood, finished.

The three-inch tiles are decidedly the most useful for all ordinary purposes. The four-inch tiles are able to discharge a very considerable quantity of water. The six-inch tiles, unless the spring is very strong, or the drains of great length, are not so much used as the two last sorts. The eight-inch tiles are seldom or never necessary, unless in very particular situations.

A very large kind of tiles for conduits at gates, &c., are sometimes made, but are not considered good for the purpose.

The wedge or brick draining, now judiciously practised on the stiff clays of the Kerses of Stirling, Falkirk, and Bothkennar, in Scotland, is certainly not so well known among practical farmers as its merits deserve; and occupiers of stubborn clay soils would do well to make themselves thoroughly acquainted with the wedge system of draining in Essex, and with the Kerse draining of Stirlingshire, which is both simple in principle and effectual in practice, while the expense (it is believed) is not very heavy.

In Scotland, and many parts of England, except in particular districts there is generally no want of stones for draining purposes; and it may therefore be supposed, and with good reason, that draining by means of tiles may not soon become general. The system of tile-draining is, however, begun in Ayrshire, under the patronage of his Grace the Duke of Portland, whose tenantry, it is understood, use them very largely, and with much success, his Grace furnishing the tiles.

There is no part of the practical branch of the art of draining, which it is so essentially necessary to attend to, and which is so frequently neglected, as avoiding throwing back into the drain any of the stiff tenacious subsoil that has been cast out of it. If this is done, in a few years there will be formed as tenacious and compact a body of clay above the tiles as existed previously to the drain being cut, rendering them quite useless, as the water can never get down to them. This error has been committed over a large portion of England, whereby vast sums have been laid out to little purpose. In order to secure the full effect of tile draining, the tiles should invariably be covered with stone or brickbats, or, if such materials cannot be got, with faggots, or even with straw, so as to prevent the possibility and necessity of any clay being returned into the drain; and which, in cutting the drains, ought invariably to be thrown to the opposite side from the better and more porous soil. Few, or no labourers can be got to attend to these obvious but necessary maxims; and it is not often that the tenant can be prevailed on to enforce them, their interest being less permanent in the farm. To secure these objects, the landlord should never permit a drain to be opened until the farmer has laid down in the lines of the proposed drains a sufficient quantity of stones, brickbats, &c., to fill up the space between the top of the tile and the bottom of the soil; and this being fully carried into effect, this important but costly, and necessary improvement, will be executed in a manner at once useful to the landlord and tenant. But previous to so expensive an improvement as underground draining of any description being set about, let every agriculturist, whether landlord or tenant, examine carefully the state of the ditches round his field, and he probably will find in nine cases out of ten that the real evil consists in their insufficient condition arising from their want of depth and want of scouring. Let them be all deepened to at least 4½ feet in depth, and wait a season, and he will probably save

a large outlay that would have been expended to little or no purpose. This observation cannot be too strongly impressed on the mind of every agriculturist.

The slovenly condition of the fences in a large portion of England is a subject of deep regret and incalculable loss. They occupy most uselessly a vast deal of land; harbour vermin to a ruinous extent; nurture weeds that it is impossible to eradicate; prevent the ditches round the fields from being kept at their proper depth, and make it impossible for them to be scoured out as they should be once in every year. These ditches stand lip full, wetting all the soil near them, which draws the moisture from them like a sponge. Or if the ditch is placed at the top of a field which has its declivity from it, it acts precisely as a line of springs on the side of a sloping bank does, doing incalculable injury to the whole of it. The removal of this source of mischief is easy, and to an inexperienced person would be considered natural and obvious; but in practice it is far otherwise, for it is proved from that which occurs in the greater part of England, that very large and serious outlays take place in underground drains, which the more simple, the more obvious, and the least expensive improvement of deepening and scouring the boundary ditches of the field would fully and effectually accomplish. It is for this reason that the attention of the agriculturist is again besought to this simple and generally efficacious remedy.

FARM REPORTS.

III. COUNTY OF SUTHERLAND.

STRATHNAVER, MORVICH, AND CULMAILY FARMS.

Communicated by PATRICK SELLAR.

INTRODUCTION.

THE county of Sutherland is situated in the 58th degree of North Latitude, parallel to Gottenburgh in Sweden, and Labrador in America, and not two degrees further south than Cape Farewell in Greenland. Its climate, and its productions, and the style of farming followed to bring these last to maturity, must differ, in many particulars, from what prevails in England.

It consists of a peninsula, nearly of a square form, washed on the west by the Atlantic, on the north by the Great North Sea, and on the east and south-east by the county of Caithness, and by that portion of the German ocean called the Moray Firth. The exhalations which are produced by these great bodies of water moderate the rigours of winter, and the heats of summer; causing at the same time a dampness during every season, more especially in the vernal and autumnal equinoxes, favourable to grass; but not in every year propitious to the sowing or the ripening of corn.

The centre and east portion of this district, excepting a narrow stripe along the south-east coast, scarcely two miles in breadth, rests on mountains of gneiss and micaceous schistus, with here and there a mass of primary limestone, or a bluff hill of old red sandstone* placed upon it. The whole is broken into abundance of wild, and, on the west coast, savage scenery; subdivided by many lakes and streams of water, and covered chiefly with peat bog, on which grow the eriophori, carices, junci, ericæ, and other alpine plants, given in his kindness by Providence to those countries, where the extreme length of winter and the absence of spring forbid, during a great portion of the year, the vegetation of plants of a more feeding, but less hardy nature.

The tillage farming of the county may, with one exception on the north coast in the Limestone district, be said to be limited to the south-eastern stripe of coast above mentioned; where the gneiss changes into sandstone, and where breccia of various combinations, and coal measures, are tumbled together in great confusion, and covered with debris from the neighbouring mountains. Here there has been formed a soil, consisting of loam of different depths, approaching in some spots to coarse

* The old red sandstone on the west coast extends from Clachtoll in Assynt on the south, to Culkein on the north. It includes the lofty interior mountains of Sonlbhein, Canisp, and Queuag. From thence to island Handa the coast is composed of round, lumpy hills of gneiss, stretching up to the base of the lofty quartz mountains of the Diriemore. The coast north therefrom, to tho vicinity of Cape Wrath, which is granite, is composed of the old red sandstone. To the east of the Cape it is again found, forming tho lofty cliffs of Clochmore and Far-out-head. The mountain limestone also forms two considerable ranges; the one commencing on the north coast at Ellan Garrow, running to the south of Far-out, extends to the point of Saugoemore, stretching into the interior to the west summit of the lofty mountain of Ben Spiunniue. The next stretches along the greater portion of Loch Eribol, and includes Ellan Choirie to the top of that sea loch. The rest of the county comes within the general description in the text.

alluvial matter of considerable tenacity, but all of it adapted, when limed, to the growth of heavy crops of turnips.

The mountainous part of the country is placed chiefly under sheep. It exports annually *one hundred and eighty thousand fleeces* to employ, and *forty thousand sheep* to feed, the English manufacturer. The shores abound in fish, and its fisheries afford more than *fifty thousand barrels of herrings* to the same end; that is to say, either for direct consumption in England, or for Ireland, where they set free an equal value of food better adapted for the English market. The part of the country employed in tillage, exports to the south country several cargoes of corn, some choice Highland whisky, and a good many droves of cattle; but it is chiefly available for the esculent food, and the refuge during winter which it affords to the weaker portion of the flocks that occupy the great extent of pastoral country, with which it is by the wise provision of nature connected.

Of the above mentioned agricultural produce of the county of Sutherland, the writer of this report may annually export about one-twentieth part of each of the above mentioned species of produce, varying in amount according to the nature of the season, and the skill and industry of the persons employed in directing, superintending, and carrying through the operations necessary to improve the quality and preserve the health of the stock, in raising the necessary food, and in defending it against the effects of climate.

He will proceed to describe—1st. his farms, which belong in property to the Marquis and Marchioness of Stafford, and he will explain,

2dly. The management employed in each department to bring out and realise the produce.

Description of Farm.—The First and most important part of the farm possessed by the reporter is in Strathnaver, a tract of mountain land, on the north coast of the county, in latitude * 58° 30′, situated betwixt Loch Naver and the sea. The river Naver runs through it from south to north, and it extends, at its greatest breadth, from Loch Laygal on the west, to Badanloch on the east.

The pasturage consists of a great variety of plants, singularly adapted to the maintenance, during every month of the year, of the only domesticated animal possessed of a cover adequate to defend it by day and night from the effects of such a climate,—so light in weight, as not to sink in the peat bog where it finds its food; and with power and instinct to *spiel* † the inaccessible crags, with which such a country abounds.

Where the waters, by cutting out ravines, glens, and straths, have formed an alluvial soil, composed of the debris of the mountain rocks mixed with peat, there the finer sorts of plants appear. These plants vary according to the quality of the component parts whereof the soil on which they grow consists. On spots, for instance, where the decomposing felspar abounds, some natural clover, rye-grass, yarrow or millefoil, mountain daisy, primrose, and other plants of first quality are discovered,—mixed with the holcus mollis, agrostes, airæ, &c. which are natural to the decomposing mica,—with the fescue grass, brome grass, common bent, heather, *et hoc genus omne*, which is content with the nourishment to be derived from the steril bank of quartz gravel. In this respect the pastures of the county of Sutherland possess an advan-

* Within about one hundred miles of the latitude of Greenland.

† Climb.

tage over many tracts exhibiting a more flattering outline; and with the ever varying proportions and combinations of matter contained in its gneiss, there is throughout the country an infinite mixture of the plants best suited for the maintenance of 'keeping stock' during every season of the year; which grasses, by the irregular bursting out of rocks in a state of partial decomposition, and by the serpentine course of burns and waters, are ultimately interwoven with the alpine plants that grow upon the peat-bog, and form the principal part of the maintenance of the stock.

Of these alpine plants, there exists a considerable number and variety. On the knolls, the heather (erica vulgaris) prevails. It fills with seed, ripening in all seasons of ordinary fertility, like a field of corn*, and forms a principal part of the food of stock, during the wet months of October, November, December, and January. In exposed situations, the shepherds burn it, and the sheep eat the young shoots in August and September. In lower positions it is left to come to greater length, so that the sheep may work down to it in time of snow, and in order to afford shelter in lambing time. Adjoining to the heather, the sheep find, on the peat of damper and deeper quality, the ling (erica tetralix), cotton grass (eriophorum vaginatum), rasp grass (carex cæspitosa). The leaves of these plants they consume along with the heather, during the autumn and winter months. In February the heather has lost its seed. It is succeeded by the pry (carex panica), the stool bent (juncus squarrosus), and by thick beds of the flowers of the cotton grass, which are found in the latter end of February, and beginning of March, pointing with great vigour to the cheerless sun of that wet and uncomfortable season. These plants continue in use, until the second or third week of April; and during all this time, they furnish for *keeping* stock, food of the best quality and in the greatest abundance. From this date to the middle of May, a link is in this country wanting in the chain of alpine eatage. On well drained and moderately stocked ground, the finer qualities, which in this season begin to spring, supply the defect, but under different management, the 'hunger rot' and a train of consequent ills sometimes ensue. In the middle of May, however, the deer hair (scirpus cæspitosus) takes the place of the moss. It shoots through the ground like a thick braird of corn, and with the fine grasses, by this time in full vigour, provides for stock most abundantly, until the month of August; when the ground is lightened by the departure of the annual cast or sale lot of sheep; and the young heather and ling come again into play.

The Next part of the concern, comprising Morvich and Culmaily, consists of a tract in Strath Fleet, and on the shores of the south-east coast of Sutherland. On the south and west it rests on the sides of a pretty considerable chain of mountain composed of inclined red sandstone, called Bhen Bhragie and Bhen Lundie. That part of this farm which falls down on the south side of the mountain, to a flat of more than four hundred and fifty imperial acres of tillage land, is Culmaily Farm; and is chiefly composed of a sharp gravelly black loam, incumbent on sandstone of very compact quality, and on the debris of the sandstone and gneiss rocks, which abound in the neighbourhood, mixed up with some sea sand and calcareous matter infused into the mass, at some remote period when it must have been covered with salt water. The other part, which is on the west side of the mountain, is barely within the gneiss district; it descends to the base of a precipitous mass of rock, composed, in a great measure, of amorphous felspar, at the bottom of which is the alluvial flat of 'Morvich,' formed

* In 1816 it filled very imperfectly, and the consequences to the flocks were deeply felt during the ensuing winter.

of a deep and pretty strong clay loam, in some part covered with moss, and measuring better than two hundred imperial acres of tillage land.

It is not immaterial to the reader to know, that of these tillage farms, full two hundred and fifty acres have been converted from moor, moss, and pasture, into tillage land by the reporter, and that he has thoroughly manured the whole six hundred and fifty acres with lime imported from England; and he mentions these facts here, in order to afford him this opportunity of adding, that he was induced to make such extensive improvements by the liberal terms granted in his first lease, the unsolicited addition of nine years to its endurance, and the abatements of rent given and other acts of kindness which have been, by the venerable Marquis and his noble Lady, conferred upon him, in common with the other tenantry of the estate.

He will not tire the reader with a detail of the numerous little experiments which have led him, step by step, to his present system of management—a system containing many imperfections to be discovered, possibly, and corrected, and in no way so likely as by the comparison of the details of his management with those of other and better-informed farmers, who may be induced, like him, to communicate their stock of ideas to this society, for the purpose of being added to the general fund collected by them, for the use of the profession.

Management.—The first outline of his management is this: he breeds and rears his flocks in Strathnaver, devoting Morvich and its adjoining pasturage grounds as a refuge for the weak end of his ewe stock, and for the purpose of preparing his sale ewes for market; Culmaily being used as the refuge for the weak end of his wether stock, and for preparing his sale lot of wethers for market. At Morvich, too, he keeps under his own eye the *élite* of his ewe stock, from which his tups are bred, and at Culmaily his tups, which are marched off to the ewe flocks in Strathnaver at the appointed time.

In going more into detail, he shall divide what he has to say into two parts—the *first* concerns his tillage, the *second* the management of his flocks.

1. *Tillage.*—His tillage land is subdivided into twenty-one inclosures, the fences of which are dykes or stone walls, all built by the tenant *, viz.—sixteen at Culmaily, and five at Morvich. The sixteen at Culmaily are wrought in three shifts, viz., six fields of the lightest quality in the course are under the rotation of—first, turnips; second, barley; three, four, five, grass; six, oats: ten fields, or two fives, are thus cropped—first, turnips; second, barley; three, four, grass; five, wheat. The five inclosures at Morvich in this course—first, rape or cole and naked fallow; second, wheat; three, four, grass; five, oats. He grows no more potatoes than are necessary for the subsistence of the people employed, and these are grown among his green crops in alternate stripes of six drills of each kind.

On each of the two above-mentioned divisions of the tillage farm there is a suitable onstead of farm buildings, and a powerful threshing mill impelled by water. On Culmaily are meal and barley mills of small size, also impelled by water, for the manufacture of his corn.

His whole tillage, as well as the transport of his wool and materials necessary for the stock land, is performed by six pairs of horses †, a grieve

* An allowance, or 'meliorations,' to be paid by the landlord to the tenant for certain improvements, at the end of the term, is stipulated for in the lease.

† Seven pairs, including one pair of mares in foal, and one pair of young horses *thrown off to grass during summer.*

or bailiff, six ploughmen, and a spadesman; a second grieve or bailiff to superintend the women employed on the farm, a millwright, and sixteen women for the two threshing mills. In summer these sixteen women, with fourteen to twenty boys and girls, according to circumstances, in addition, clean the green crops; and in harvest ten to eleven bandwin, or from sixty to sixty-six reapers, with ten to eleven binders, under the superintendence of the second bailiff, cut down, bind and stock the crop. The grieve has at command a hardy Highland pony; and the farmer who resides at Morvich, two riding horses, to one of which can be yoked a light gig, for his conveyance to distant parts of the farm.

He will proceed to describe, as briefly as possible, first, the habits of his people and the practices used in his tillage farm; and secondly, the particular detail of his tillage applied to each species of crop grown.

The grieve or bailiff and four of the ploughmen are married men. Each of these families possesses, during the year, a house and garden, a milch cow, at all times well fed, thirteen Scots bolls or 16¼ cwt. of oatmeal, three Scotch bolls or about three cart-loads of potatoes, a limited quantity of English coals, of the best quality, and a money wage. That of the grieve varies with circumstances. The money wages of the ploughmen may average about ten pounds each. For the above allowance each family keeps a young man within the house, and, if any circumstance put two young men to lodge with one of the families, there is allowed 6½ bolls of oatmeal, one boll of potatoes, fifty-two shillings per annum, and some coals, for the additional lodger. When the force comes to Morvich the men are fed in family with the shepherds there, and 17½ pounds of meal per week are deducted from each man during the time he is so maintained.

Various plans have been tried on the farm; but for several years the above-described method has been adhered to as that which, on the whole, has wrought best. The young men were found to be made more steady by the society of the married family, and the married servant went with a better spirit through the *unremitting labour* attendant on his lot, when he saw his family admitted to as much comfort as could, in these bad times, be afforded; and the prospect before him of assistance from each of his children, as soon as they could gather a weed or hoe a turnip.

There are eight additional families on the skirts of the tillage farm; each of whom at a nominal rent possesses a house and garden, a cow's grass, and a patch of ground, and who, when required, work on day's wages: the younger children at fourpence, girls at sixpence, old men and lads at one shilling, and able men at one shilling and sixpence per day of ten hours. Their cows are not well fed; they give no milk in winter; but each family has a trifle of bear or bigg * in a small stack behind his house, from each two pecks (three pecks imperial) of which his wife could brew sixty quarts of small beer for her family, were she not prevented by the fifty penalties of the cruel and impolitic malt laws.

In the latitude of Sutherland there is a great diversity in the length of the day and night, at different seasons of the year. From the middle of November to the 1st of February there is no light to perform field work before eight o'clock in the morning, or after four o'clock at night. The practice at this season is, for the families to start at a little past six, and light their lamps. By the light of these, while the women prepare breakfast, the men clean their horses, water them, put the harness on them, one feed of corn † for each horse into the manger, and another into the mouth bags. At dawn they draw out, and begin a yoking or journey, which, with

* A species of barley.

† One peck and one gallon imperial, make four Scotch lippies or feeds.

an interval of twenty minutes to empty the mouth bags, lasts until dark. They then return, water their horses and wash their feet, unharness and dress them, fill the rack with oat straw, and the manger with well-washed yellow turnips, on which the horses amuse themselves until eight o'clock. The men in the mean time dine, and at eight a bell is rung, the lamps lighted, the horses thoroughly dressed, the racks again replenished with fodder, and the manger cleaned out and filled with a mash, made by one of the ploughmen during the evening of the preceding day, consisting of one feed of light corn for each horse, boiled up or rather stewed with yellow turnips cut down, bran from the meal mill, and chaff. This closes the duty of the day; the men sup, go to bed, and sleep soundly until six o'clock again rouses them to their work.

In February, the day lengthens out, and the yoking lengthens with it until it extends to two journeys of five hours each; at which time the horses begin to be fed with hay in place of straw. The lengthening day now gives an interval for dinner at mid-day, which increases, by the 20th of May, to three hours; and this interval is permitted to them for dinner and rest. They dine at eleven; and most frequently sleep behind their horses from twelve to nearly two o'clock, when they begin their second yoking of five hours. By nine o'clock they are all in bed.

At this time the green crop seed time begins, and with it the two journeys increase to eleven, and sometimes twelve hours, the horses getting three feeds each per day. The people, at this time, start, feed, and breakfast at four, yoke at five, rest at eleven, when they dine, and rest till two. At this hour they begin the second journey, which lasts until seven, half past seven, or eight, according to circumstances. These seeds are all got in before the 1st of July. The horses are then put to grass: young horses allowed to amuse themselves for the season, and the remaining five pairs restricted to two feeds of corn and ten hours' work, until the cold nights of autumn bring them back to the comforts of their stable; and the short day of November to the arrangement which was followed in that month of the previous year.

The yearly expense of one man and pair, fed and wrought according to the above method, is 80*l.* For the whole six hundred and fifty acres, and other cartage, six pairs, being at the rate of one hundred and eight and a half imperial, or about eighty-six old Scotch acres per pair. The grieve never leaves these teams: he sees them dressed and fed, and he sees them wrought; and the master's eye follows him in every step. The fields are ploughed in regular divisions, the strength concentrated almost perpetually to one object in one field, and the cartage performed to time, by regular yokings; and the writer does not think, that a much greater extent of work could be performed, at the same expense, with justice to the men and cattle. At the same time, he is aware of imperfections; and if better farmers will give a minute detail of their mode of working, he will gladly borrow from their better judgment.

Piece or task work, except in small detached jobs, has not yet found its way much into tillage work in Sutherland. To greater exertions than time-work it certainly leads, and to greater irregularities than is admissible in a well-regulated system; but it saves the trouble of superintendence.

The duty of the second grieve is to attend the threshings that are performed by the millwright and eight women at each onstead; to watch over the care of one hundred and sixty wintering cattle, under the superintendence of three lads; to hand-weed the fallow-breaks, and to hoe better than one hundred and twenty acres of rape and turnips; and with ten or eleven bandwin or bands of reapers to cut, bind, and stock the crops.

In threshing, the first rope of thatch is loosened, and the sluice drawn at eight o'clock: one of the women, with a boy and horse, carts in the corn; the miller feeds; the seven girls attend, each her particular part of the machinery; and by four o'clock, the fodder of two ten-quarter stacks is thoroughly separated from the corn, and strewed for the cattle, the corn separated from the chaff, and measured over by the second grieve and miller to the granary-keeper; and this person's receipt for the quantity in the master's pocket. The expense may be as follows:

	£.	s.	d.
Millwright, two-thirds of a day	0	1	8
Second grieve	0	1	0
Eight women, say eight hours, 64—say 6½ days	0	3	3
One lad and cart	0	3	0
Say 5½d. per quarter	0	8	11

This, for oats, barley, and wheat, may cost sevenpence to eightpence per quarter.

No other general remark occurs, except on the subject of manure. On Culmaily-farm there is a very considerable supply of sea-ware, of very excellent quality; on Morvich, which is more inland, there is great abundance of fern or breckan (filices), which grows luxuriantly on the soil composed of the debris of the felspar rock, and yields putash. It is the practice to mix the sea-weed with the court-dung, in alternate strata. The dunghills so formed being hard trampled down by the carts and the feet of cattle, the mass is found in the beginning of May to be strongly saturated with an infusion of the muriate of soda. It is turned over and slightly covered with mould, for fermentation, preparatory to its being applied to the soil, and it forms a manure of the very first quality. The ferns are cut green, brought together into a great stack, where they ferment to a considerable degree; they are subsequently trampled down under the sheep's feet at sortings, smearing, and at shearing time; and being mixed and further fermented in the mass with court or fold dung, they are therewith applied to the naked fallows about to be sown with wheat.

The first and most important part of the rotation employed, is the growth of the green crop, that is, cole and turnips; for they are managed in precisely the same manner. This species of crop is most important in two respects: first, as the pharmacopœia for the whole stock on the farm, and secondly as the key-stone of the system of tillage farming employed—and that on which the quantity and quality of each succeeding crop of the rotation depends.

Green Crop.—The green crop, of course, succeeds a culmiferous or corn crop. The first operation is a furrow, in the direction of the former ridges, given immediately after harvest and the conclusion of the wheat seed: the ground is cast into breaks fifteen yards broad, and the ploughing so deep as to leave some of the lime visible below the plough sole. When this work has been completed, the field is neatly water furrowed, and left to receive the fertilizing effects of winter.

On fields of light soil, when the crop is intended to be sown on bone-dust, the gates remain shut until after the conclusion of the oat-seed in March. On loams of heavier quality, where dung is to be employed, four dunghills are founded on the head-ridge, two at each end of the field. The foundation is composed of virgin mould or ditch scourings, two feet deep; over this are placed, in alternate strata, four layers of fold dung, and four of sea-weed; and the mass, when completed, is neatly spaded up, covered

on the sides and top with mould, and the field shut up to wait further progress at a more advanced period.

When the oat-seed has been completed, the gates are opened, the water-furrows shut by the plough, the field thoroughly harrowed and hand weeded, cross ploughed in wide breaks, and again harrowed to perfection, and every weed gathered into heaps, burned, and the ashes spread. This done, and the dunghills being at the same time turned for fermentation, the gates are again shut, until the completion of the barley-seed, when the tillage is renewed in one of two ways.—If a very light field, it is again severely harrowed by cattle travelling at a quick pace, and hand picked, &c.: if a field of better staple, it undergoes a third ploughing across the former one, a rolling, harrowing, and hand picking; and in both cases it is left in a highly-pulverised state to wait until seed time. When the people open the gates to begin sowing, they like to find a young and scarcely perceptible braird or growth of annual weeds thinly scattered on the surface.

At the time of sowing green crops in Sutherland, the dusk or twilight of the evening glides into that of the morning, without passing into night; when the sun has a most powerful influence. The seed process is, therefore, carried through with every possible despatch. The method followed is twofold: in each case it is preceded by a deep furrow-line, to define the head-ridge on each of the four sides of the field.

1. Where dung is to be employed, two ploughs, which are yoked twenty minutes before the carters, open drills, furrowing an acute angle with the side ridges; to favour the admixture of the dung next season in the mass of the field, these furrows are from twenty-seven to thirty inches wide, according to the quality of the soil. Four single carts follow, two at each end of the drills, and deposit dung in these drills at the rate of fifteen to twenty tons per acre. Six girls spread the dung as fast as the carters deposit it. Two ploughs, which yoke forty minutes later than the carters, cover in the dung. A few boys and girls hand-pick the whole. The sowing machine follows and rolls in the seed; and at the termination of each yoking, three acres, which at the beginning lay flat and damp from the former tillage, is drilled, dunged, covered, hand-picked, sown, and completed. The machine sows two drills at once. Its rollers are formed to encompass and embrace each drill. The two sets of rollers (one for each drill) are separate, and diverge on an iron axle in such a manner, that they can be made to deposit the seed only on the top of the drill, immediately incumbent on the manure—a condition which insures a more equal and a better crop than where less perfect tillage is employed.

2. When bone-dust is used, fourteen quarters of the manure is wet and covered for fermentation forty-eight hours before the yoking begins. The horses cart this to the field at yoking time, and the loads are set down at measured distances in different parts of the field. Two ploughs open the drills; ten boys and girls manure, carry, and sow the dust into the drill, which is in a state of incipient fermentation. Four ploughs instantly cover in. The sowing machine follows, and from four and a half to five acres are completed at a yoking. The machine is regulated to sow from one to four pounds of seed per acre, according to the farmer's intention. The quantity sown is generally about two pounds to the imperial acre. In all cases the seeds are floated, the lights skimmed off, and the good seeds dried with flour of sulphur, all at the time of sowing. The sulphur is thought to preserve the seed from vermin. The dampness, however, communicated by the floating to the seed, and the fermentation incipient in the manure, does, with greater certainty, at that sunny season, send up

a regular vigorous braird, and carry it quickly to the rough leaf, at which stage it is secure from the fly.

Some farmers use bone-dust sowing machines drawn by two horses. The writer of this report, on the whole, prefers manual labour, performed after the fashion above described, to any sowing machine which he has yet seen.

Besides rape or cole he grows four different kinds of turnips. At the part nearest to the mountain (intended to be first used by the sheep) white globe; in the middle, red top and green mixed, four drills and four drills alternately; at the bottom, for spring eatage, yellow, one-fourth part may be white globe, two-fourths, or rather better, red and green, and the remainder, where the field suits, yellow. The white for early eatage in November and December, and for quantity per acre, are unequalled, but their thin skin renders them too tender for the frosts of January and February. The red and green, with great bulk, are proof against the severities of winter. The writer of this report mixes them agreeably to that law of nature which gives *none* of its eatage in one single species; and he thinks the sheep like the variety which is in the two sorts mixed. The yellows, as they retain their sap longest, are decidedly the best for the spring months. The different sorts are made to follow each other in the same drill, by using different seed-boxes, which are exchanged at the different parts marked in the field; the removed one being laid down on the top of the nearest two drills to wait the return of the machine.

The Scotch farmer will pardon this minute detail of his every day work, which is submitted to the English reader in case he should choose to give a fair trial to the *drill* husbandry in the cultivation of turnips.

The writer invariably grows his own turnip seeds. He plants his four different lots of roots far distant from each other, to prevent hybrid admixture, having first selected the roots with great care from the field in which they had been sown. Where, in the course of his little tours, or by correspondence, he can pick up small samples of what is called good seed, he sows them, marks the drill in his weekly report, and pricks from them in the ensuing month of November whatever may seem likely to give a good cross in his seed plots, one load to ten of his own sort, perhaps; less or more as he may judge advisable at the time: it is a measure to be adopted with great caution. Some samples which he obtained from Aikeld and Kelham, in Northumberland, from Samuston, Roxburghshire, from Leming Lane, in Yorkshire, and from Dalswinton, in Dumfriesshire, have done him a deal of good; other samples obtained from gardeners and nurserymen have turned out to be trash in some cases, and in others to be of the very best breeds.

But to return to the tillage: the green crop sowing begins with the rape, as formerly mentioned, about the 25th of May; it concludes before the last week of June. Two horse hoe harrows, followed by twenty or thirty hand hoes, attended by the second grieve, are then set on, first to the rape, and so forward through the turnips, to the latest sown crops. By the time the latest sown is completed, the first sown is ready for the second hoeing. The horse hoers then exchange their harrows for small double mould-board ploughs: with these they set up the crop lightly, and thus, about the middle of August, concludes the tillage. In some cases, however, a second and more effectual setting up takes place in the month of December, of that part of the crop intended for latest use, after the first frosts have made it plain that no further increase of crop is to be expected.

By the above process the ground is left without the vestige of a weed, and the crop does, generally, in every case, completely cover the soil. The

Culmaily turnips have, this season, been tried by pulling and weighing measured spaces, as fairly as possible, over different parts of the field, and the following are the results :

	Fold Manure.	Bone Dust.	Average.
White Globe, per imperial acre	T. 20 8 2	T. 35 2 3	T. 27 15 2¼
ditto	18 5 1	33 17 0	26 1 0½
Green Top . . .	18 1 0	31 10 1	24 15 2¼
Field yellow . . .	0 0 0	25 12 3	

This was not a fair experiment betwixt bone manure and fold dung mixed with decomposed sea-weed, since that sown with dust was much the best field of the two. But it shows clearly the proportions which the different sorts of turnips bear to each other, and the causes why, for keeping stock, the writer prefers to have his greatest quantity of the coarser and more common sorts. Of Swedes and mangel-wurzel, he has, for many years, grown none. Whether from the nature of the climate or the soil, he could never bring them to a full crop, and as his sheep hospital, in a great measure, breaks up when the cotton grass comes into flower in March, he found no inducement that he could balance against the sacrifice of quantity.

Barley.—When the turnips have been eaten off by sheep, the surface of the field bears some resemblance to a macadamised road. So far as compression goes, it is certainly not much different from lea, when about to be broken up after pasture. It is usual to cross-rib and harrow it before giving the seed furrow. In strong land, indeed, it sometimes gets a previous clean cross furrow ; in soft sandy loams a seed furrow on the turnip break is found quite sufficient. No weeds grow among the corn sown up to grass, and it is never drilled but invariably sown broad cast. The broadest sowing machine is an invaluable article, although extremely apt to be bent in the rods, and otherwise spoiled by the rough and unskilful hands which use it. The quantity of seed given varies from three to five bushels, according to the quality of the soil. The seed time endures from the 1st of April to the 1st of May. Early sowing has not been tried ; but by what is said on that subject in the Society's report, No. 1, the writer of this paper intends to make the experiment in February and March first. The returns vary from thirty-nine to fifty bushels of a dark coloured heavy weighing grain, in good favour with distillers.

Grass.—One advantage derived from our late period of sowing is the opportunity afforded of putting in the grass seeds in good time to be covered by the last turn of the harrows, which follow the seed corn ; a method affording a better braird and more vigorous plants than when the seeds are rolled in after the barley has got above ground. On soil of the first quality one bushel pacey rye-grass, having a good admixture of rib grass in it, eight pounds white clover, six pounds red, and six pounds trefoil. On soil of the second quality, one bushel and a half ray-grass, eight pounds white, four pounds red, and six pounds trefuil ; and on third quality, two pounds of ray-grass, eight pounds white, six pounds trefoil are usually given ; to which, in very light moor land, he has very successfully substituted fur barley half a peck of rape seed. In this last case an inclosure of very worthless land becomes, both in autumn and spring (April), a nursery for the weak part of young stock of first quality.

One inclosure, of best quality, is invariably set aside for hay to the working horses. That it may come early to the swaith, it is never permitted to eat it down in autumn. To save the esculence of the hay and the fertility of the field, it is cut the instant the ray-grass comes into

flower (excepting what is required for next year's ray-grass seed), and an exertion is made to get the hay carried before the 8th or 10th of July.

1st. That the aftermath may be, at speaning* time, open to recruit the weakset and worst fed lambs; and, 2dly, that the hay-making may be put past, after the cleaning of the rape, and before the succession of turnips sown, press, for hoeing, on the hay-makers. The young people employed on these works are sure to quit the farmer by the 1st of August, to employ themselves in the herring fishery; and the farmer, whose summer hand-work is not, by that time, completed, has a very poor chance, for that season, to bring his green crops to a successful termination.

Besides this field appropriated for hay, the rotation gives six inclosures at Culmaily, and two at Morvich for pasture. The two at Morvich are devoted as a summer nursery for the ewe stock; one at Culmaily as summer nursery for the wether stock; one for the 'work horses, colts, and servants' cows; and the remaining four prepare the sale cattle for market. The fields at Morvich not being eaten bare by the sheep, the scythe is passed over them as soon as the lambs have been speaned, and the ewes sent to the heather: the grass cut, made into hay, and carted off as speedily as possible, that a short close bite may in good time succeed for the further progress of the stock.

The cattle alluded to are all bought in from the people who are settled round the shores of Sutherland, in small luts of land, for the prosecution of the herring fishing. These people have one, two, or three cows each. They sell the calves at from nine months to a year old. The tillage farmers buy them, and prepare them to travel south. The writer of this report uses yearly from seven to eight scores. He buys them in April, puts them, during summer, on his *superabundance* of deer hair, transfers them from that in August to certain coarse rushy loams, where coarse grass grows, brings them to his courtines at Morvich and Culmaily to eat straw in winter, and finishes them off for the road during next summer in the inclosures above mentioned. With some little assistance from the field appropriated to the horses, the four fields summer, on an average, with attention, at the rate of 1½ per acre. It is the practice to fill up two fields with three cattle per acre, and to shift once a fortnight.

The breed is the Norland Kyloe crossed, in some cases, with the Argyleshire breed, of which the noble Marquis has long kept a selected breed at Dunrobin. I am of opinion that had proper skill and attention been used to infuse the Argyleshire blood into the Norland breed of the country during the last thirty years, during which his lordship has possessed the means of doing so from Dunrobin, they would, at this date, have doubled the value of the cattle export of the county of Sutherland. Assuredly the farmers could afford to the people for their yearlings twice the price now paid, were they bred in a different manner; and this remark is peculiarly applicable to the north coast, where a great mixture of worthless Caithness blood prevails.

The sales fur the southern market happen in July, August, and September, and they clear the fields in order to prepare them for sowing wheat.

WHEAT.—Until bone-dust manure came into use, this mode of cultivation could not be advantageously followed; and it is doubtful whether oats may not, by and by, be fonnd, after lea, the best crop of the two. In the mean time no farmer can refuse the premium offered by the corn-laws, of 60*s.* for wheat, in preference to 24*s.* for oats.

* Weaning.

The first operation is, to spread the dung saved from the green crop on the leas. On strong lands a cross rib or break furrow is usually given a few weeks before the seed furrow. To prevent the seed from being deposited too deeply in the soil, it is usual to give one stroke of the harrows before the sower. The seed being steeped in the field among stale urine, lights are skimmed off, and the good corn is instantly dried with hot lime and sown, and no smut has hitherto followed. On light sharp loam, and on the rape land previously eaten down by the small sheep, it is sown upon one furrow; and in all cases the field is directly and effectually water-furrowed, and shut up for winter.

The produce varies from twenty to forty bushels per acre. The species sown is the thin-chaffed Essex; in some cases the Talavera. The quality produced is coarse, and generally ground down for ship biscuit. A few additional plantations and greater skill may improve the quality in a degree. Still wheat is not naturally fit for the country or the climate.

Oats.—On the lightest soil in Culmaily the author sows Angus oats after one furrow in spring: on the whole leas at Morvich, potato oats after the same degree of cultivation. The Angus oats are generally consumed in horse food, the other in meal, for the use of from thirty to forty families employed on the farm.

The oatstraw is given to the horses in winter, and to the Kyloes at that time when the catage has got bare, and the turnips cannot be spared from the young stock, which wait, at Culmaily, for the return of the flower of the cotton grass.

Sheep.—But, most assuredly in such a country as nine-tenths of the county of Sutherland is, sheep are at present the only animals fitted for converting the vegetation into realizable value; and without the free use of that part of the country fitted by nature for affording to the flocks refuge from the wintry storms of the gneiss district of mountain lands, *that value cannot be brought out*. On some ill laid out farms, not one half, and others not much above one-third of the lambs bred, come to be sold as grown sheep; and the survivors, when sold, are of inferior quality, and bring a very poor price.

The plan followed by the writer of this report to save these losses, and to make his sheep worthy a better price, he will frankly lay before the reader, after premising, first, his consciousness of many imperfections in it, and, secondly, that what suits his particular position may very possibly be unadapted to any other farm; and most assuredly it is so, according as the nature of the ground, the climate, the extent, or the position of each particular farm, with respect to markets, varies from another.

The sheep reared by the reporter, is the Cheviot, which is one of the many varieties into which the *ovis aries anglica* has, during the lapse of ages, multiplied in consequence of the differences in climate, food, and treatment, to which it has been subjected. The Cheviot hills are, perhaps, the steepest and the highest ground in England to which this species of sheep has been naturalised; and it is quite comprehensible for a store farmer to understand how nature, seconded by the wishes of the shepherd, should have gradually changed the forms of any of the low country varieties, to the light fore-ended, short and close-woolled animal which is found among the border mountains. In fact, one can scarcely tread on the pasture of the Cheviot and survey the plains below, without seeing, that as often as the ancient borderer brought to his mountains the varieties of stock found in the neighbouring vales, the scanty spring food, the elastic air, and other peculiar features of this new country, behoved to fashion

the *survivors* of the lambs there bred, and even, if young, the ewes that suckled them, to the small-neck, light fore-end, fine short stunted wool, and other properties of the old Cheviot breed.

The Messrs. Robsons, of Belford, Samuston, and Philogar, in Roxburghshire (from whose stock a great portion of the reporter's sheep have been bred), informed him that, about the year 1770, that family imported from Lincoln, Gloucester, or Hereford, several sheep, a slight infusion of the blood of which into their flocks was attended by the best effects. Betwixt that time and the year 1790 the discovery of the use of green crops and various other improvements had been made, and must have greatly forwarded the views of the spirited and intelligent border farmers of those days. From the year 1790 to the year 1800 the weight of the Cheviot fleece is quoted at 2½ to 3½ lbs., and the quarter of mutton 12 to 18lbs. At this day (1830) the weight of the reporter's sheep bred in Sutherland may be—fleece 4 to 4¼ lbs.; quarter from 18 to 26 lbs. avoirdupois. Certainly, in strength of withers, fulness and breadth of chest, strength of loins, length, breadth, and cleaving of the rump, depth of twist, and furnishings of the arms and thighs, most likely, too, in constitution and propensity to feed, the Cheviot sheep of this day exceed that which went before them.

The reporter's sale sheep are marked as in the foot-note *. They have generally been fed for the Leeds, Manchester, and Liverpool markets (though some of the ewes have been, and are now, feeding much further south); and it may happen, that some reader of this report may have seen, and will know them, by the marks now given.

When he determined to put his pasture land under Cheviot sheep, he resolved thoroughly to drain the surface of it in the manner then done on the eastern borders, and to put his flocks under the superintendence of border shepherds. They were chiefly young men, who married and brought north their sweethearts with them. He settled them in cottages on suitable parts of the farm; giving to each, where the situation admitted of it, a young man to board with them, in the manner agreed on with his tillage servants. The shepherds' wages, however, much exceed those given to ploughmen. If a shepherd does his duty, he must exercise a deal of consideration, and undergo much hardship; to which the man whose sleep is soundest in the wildest storm, and whose meat is regularly placed before him daily at certain hours, is not subjected. The householder is afforded a cottage and garden, thirteen bolls of meal, grass for three cows and one poney, with the profit to be derived from seventy Cheviot sheep of the different sorts each, mixed among the master's sheep of the same kind. The young men get board and lodging in the householder's family, and the profit derived from sixty sheep. The reporter employing eleven married shepherds and eight young men, this gives the number of twelve hundred and fifty shepherds' sheep or packs mingled among the master's flocks and spread over the farm†; and thus, something very like a partnership concern tacitly exists

* Each sheep has the letter C branded or burned in the far cheek, and a S imprinted with tar on the near rib.

Each wedder has a fore bit and hole cut with an iron out of the far ear.

Each ewe has four bits in the one ear and a fork in the top of the opposite one.

Some of his admirers have been known to *go to market* with the S, but they have not yet ventured to assume the other marks.

† The packs have marks totally different from the flock, and their faces have no brand or burn mark. The master keeps the shepherds' accounts, and balances them by double entry: if he do his duty, deception cannot take place. So many checks arise out of the system, that he would quickly discover anything wrong. They are a well-paid, and generally, almost universally, an honest, trustworthy class of people.

between master and servant; for, although the management rests entirely with the master and his managing shepherd, yet is every shepherd, old and young, deeply interested in the skill, prudence, and vigour employed; and that master will prosper badly who does not hear, and patiently inquire into, all that every shepherd has to say, concerning each and every part of the management; taking due care as he goes on, as much as possible, to identify the interest of each with that of the whole community.

By favour of the land surveyor belonging to the estate, the writer of this report communicates to the Society a sketch of a part of those demesnes in Strathnaver of which these farms form a portion; and on which is particularly marked those lands described in the following pages of this Report [see page 87.] Strathnaver, it will be observed, is subdivided into nine herdings, marked 1, 2, 3, 4, 5, 6, 7, 8, 9; and the sheep of each herding bear the figure, during summer, and the keel* mark in winter, of that particular herding to which they for the time belong.

Before explaining his particular mode of working the stock of this farm with Morvich and Culmaily, the reporter must mention one or two particulars appertaining to the farm, which had weight with him in deciding on that management. In the first place there turned out to be no one herding on it, where, in the ordinary mode of laying on and tending lambs or hogs, they could be kept, without an enormous loss, by an inflammatory disease of the stomach, called 'sickness,' or 'braxy.' They were tried in separate herdings, and they were tried following their mothers throughout the year; but with such bad success, that the loss seldom fell short of fifteen per cent., and varied betwixt that and thirty. Secondly, several of the herdings, which were in a greater degree incumbent on mica slate, with little variety of fine grass on them, were found subject to a disease called pining—a general wasting of the body, and prostration of the strength of the animal, followed, if not cured, by death. And lastly, the skins brought in were found to consist, in a great degree, of those of the youngest and worst-fed lambs, which fell at every age by pining, or drowning, or both, after having gone through the ordeal of the braxy.

Four remedies for these evils were devised, and with some success. First, for the pining, it occurred that the immediate removal of the patient from its former 'haiff' or herding, to felspar land, and from that, if necessary, to the sandstone land at Culmaily, might be efficacious. It was tried, and with such good effect, that, when taken in time, the felspar land alone answered the purpose. In other cases they were obliged to be sent down to Culmaily. Secondly—The wedder lambs, five hours of rape and turnips, with nineteen hours of heather, per day and night, effectually saved. Thirdly—As it had been discovered that, after several years' depasture of certain herdings by old sheep, lambs might, for one year, be trusted on them, if well herded; therefore, in order to save the ewe lambs, the farm was thrown into the following courses—Nos. 1, 7, 4 of Strathnaver and Morvich were called four-ewe and ewe-hog herdings, of which three kept ewe flocks, and the fourth ewe hogs, after it had been three years bitten by grown sheep, and Nos. 2, 6, 9, were wedder herdings, one of which was under ewe hogs, after having been two years bitten by grown sheep. Lastly, to save the young lambs, the lambing was made as early as the climate permitted. The speaning was performed nearly a fortnight sooner than had been formerly practised, and the youngest and poorest lambs were sent at once to the best and most successful pasture, the more quickly to advance them to maturity.

* Red chalk.

By a vigilant attention to these measures the losses on the farm were reduced nearly one half, and the stock of every age exhibited a greater degree of health, and the sale lot more equality, than the reporter or his people had in other circumstances seen.

To stimulate the shepherds to individual exertion, the reporter is in the practice of throwing out little premiums for competition among them, and he believes they do exert themselves very fairly. Nevertheless, there remains seven to eight per cent. annual loss on sheep lambed on the farm, and from ten to fifteen per cent. deficiency on what, from the number of ewes put to the tup, ought to be lambed, against which he has not yet prevailed. Younger men will be found hereafter, who, possessed of greater science to arrange and skill to execute, will point out the errors of this day, as the present stock farmers smile at the folly of those who went before them, and who were content with the trifle which they realized from the cattle and Highland poneys that waded through the undrained bog and trampled it into mire.

In going more into detail of his management, he will first exhibit the manner in which his flocks now possess his farm, and then, beginning with the lamb when *unhived* at speaning time, he will show how each sort of sheep is with him treated from that time until it go to market.

In this year (1830, 1831) Nos. 1, 7, 8, and 4 are under ewes: Morvich and the north side of No. 2 in ewe hogs; Culmaily in wedder hogs 3, and part of 9 in yill gimmers*. South side of 2 and 6 in dinmants†, and 5 and part of 9 in wedders; Morvich at the same time keeping the small end of the sale ewes and the ewes selected for breeding tups; Culmaily the small end of the sale wethers and the tup hirsel, and reserve being kept as follow:—In Culmaily for any wether sheep diseased; Morvich for ewe sheep diseased; the felspar land of No. 2 for sheep pined on the west side of the Naver, and that of No. 6 for sheep pined on the east side of that river. When the cotton-grass flowers in March, the following shifts will take place:—Morvich ewe hogs give place to the sale ewe lot from 7 and part of 8, which are then brought in to lamb, and, consequently, to spean early, and prepare themselves to travel south. The wether hogs in Culmaily give place to a limited number of the small end of the sale wethers, which make greater progress there than on the mountain land, and thus prepare themselves for their further destination.

Speaning.—Then to begin with the lambs. At speaning (weaning) time, which happens in the sale ewe hirsel about the 11th, and in the keeping flocks about the 18th of July, the lambs are found with the marks which had been put upon them at cutting time in April and May, and which consist of the ear marks of the owners and the figure or 'buist mark' of the hirsel. This figure on the pack sheep was reverted on the shoulder to facilitate after sortings.

The operation begins by gathering the flock, shedding off yell sheep (or those which have no lambs), and telling the numbers on hand. This generally occupies a day. The yell sheep being despatched to their proper places the ewes and lambs are committed to their ewe herds, who watch them during the short nights of this season. By daylight next morning, the flock is folded; by seven, the lambs are separated from their mothers; the mothers sent off under their own shepherds to the barren ground where their milk is to be dried up, and the lambs left in three folds. The first contains wedder lambs, the second ewe lambs, and the third packs. At this stage

* Ewe hogs once shorn. † Wedder hogs once shorn.

the men generally breakfast in the fold; immediately after which the wedder lambs are divided into three sorts, called tups, mids, and paleys. The tups are branded with a hot iron, buisted with a distinguishing tar mark, and, under charge of the second wedder hog herd, despatched to a tract of coarse pasture along the banks of numerous little burns (on 5 and 6) which fall into Loch Laygal, there to be tended until the middle of September. The mids are in like manner branded and buisted, delivered to the third wedder hog herd, to be summered, until the middle of August, on No. 2, where several little burns fall into Badanloch; and the paleys (young weak and stunted lambs) are, under the charge of one of the principal men, sent directly to the hay-fog or aftermath, and other succulent food prepared for them at Culmaily. The ewe lambs are then sorted into three lots:—First, the paleys are chosen, branded, buisted, and despatched straightway to the hay-fog prepared for them on Morvich. Secondly, the worst-bred lambs are despatched to the outskirts of the wedder herding, intended to be in that year shifted to hogs. And, thirdly, the tops (the most choice and best breed) possess the outskirts of the ewe herding, to be in that year shifted to hogs. The packs, or shepherds' lambs, are divided into two sorts, sellers and keepers: the first, being *keeled*, or marked with red chalk, are delivered to the buyers, or put into an inclosure to wait their arrival; the second are divided among the flock lamb hirsels. This concludes the speaning.

Wedders.—When the small wedder lambs reach Culmaily, generally to the amount of fifteen to twenty scores, they are, after a few days' rest on the Sandstone mountain, minutely examined, any lame ones dressed, the weakest portion put into the hay-fog, then about three weeks old, and the rest admitted to the sweetest of the mountain-grass. About the 12th August the sale wedders are delivered, and the mid lambs from No. 2, and the best of the paleys, are admitted to their place. By the 12th September the rape is ready for use: the lambs, then paley, are sent to five hours' rape and nineteen of heather in the day and night. The mids are admitted to the place formerly possessed by the paleys, and the tops from No. 5 and 6 to the former position of the mids. In this posture the lots remain until about the 15th October: the early turnips being now fit for use, nets are set up across the tops of each of three fields, a lot smeared * into each, and five hours' turnips to nineteen of heather † allowed for the rest of the season. With March comes the cotton-grass flower; what turnips remain are then mostly consumed by cattle, and such of the wedder hogs as are fit to face the blast proceed to Strathnaver—the best lot by the first week of March, the next about the third week of March, and the worst about the 1st April: one or two scores may be unfit to go sooner than Whit-sunday.

It is observed at speaning-time that the paleys consist of two sorts, *viz.*, first, well-bred lambs, which, by reason of being very young, or twins, or badly fed by their mothers, or some other misfortune, are much under size; and, secondly, ill-bred lambs, marked by a *tendency* to short, stubby faces, broad bumpy wiry brows, flat ribs, sharp shoulder-top, round gruoing-bones, and twisted legs. When the spring sortings take place, the well-bred mids and paleys are generally found to have advanced

* The smearing is an application of salve composed of butter or oil mixed with tar, turpentine, or some other substance, to the root of the wool, for the purposes of killing vermin, protecting from wet, and increasing the softness and the growth of wool.

† There is a waste of manure dropped on the heather land, but no remedy for this is known that is consistent with the health and hardihood of the young stock.

themselves to the tops; the ill-bred sheep have as certainly sunk to the bottom, and the last one or two scores which, with equal or superior feeding, lie on hand until Whit-sunday, are nearly altogether composed of that sort of stuff.

And here the writer cannot help anticipating an observation, which perhaps would have come in better further on—that the difference in expense of keep, loss by death, and of ultimate profit, in favour of well-bred and against ill-bred stock, is so great and striking on a sheep farm, that the apathy of many stockmasters to the subject is incredible. The reporter and his leading men, year after year, have observed the lamb of a bad ewe a mid or paley—the same lamb unfit to go out in spring—the same beast brought in to make up for sale in its last year—and after all this extra expense, sold as a shott, at twenty per cent. under the price of the lot, merely on account of the base blood which flowed in its veins.

When the month of June has brought its interminable day, the wedder hogs yield their first fleece. They are then called dinmants; are sent back to the deer hair; and when it fails in August, and the sale wedders have gone south, they are sorted into their wedder herdings to replace the waygone lot of the last year's ewe hogs; and after two years' stay there, they travel, in their turn, to the feeder.

Ewes.—The ewe lamb follows a course somewhat different from the wedder. At the delivery of the sale sheep, it falls into the finest grass on its herding—the paleys in Morvich—the worst bred full-grown lambs in the wedder herding—and the choice lambs in the ewe herding, made vacant by the cast of the sale sheep. The intention of this arrangement is, that the keeping lambs may, as far as possible, be at once haifed to that herding where they are to be settled as ewes; the deaths, &c. be beaten up from the best bred of the second chosen lambs and paleys; and those least fit for breeding be yelled off for sale—the smallest in the ewe herdings by being protected by means of a contrivance called 'brecks,'* and the largest and strongest by being sent to the herding No. 3, which abounds in those plants best calculated to give increase of bone.

The contrivance of yelling or breeching a certain number of ewes in each herding, besides the advantage it offers in the improvement of the breed, answers an excellent purpose at lambing-time; for the yell ewes being all sorted off the herding a few days before the lambing begins, a greater abundance of feed is left to bring milk on the ewes, and thereby to put layer on their lambs—an article which it becomes the policy of the store-farmer never, if he can, to lose until he quit the sheep to the feeder.

These ewe flocks are tended, as formerly explained, in three double herdings, and one smaller or single herding; and it was also observed, that one of these double herdings is cleared out annually, to receive the choice or keeping ewe lambs. The single herding yields a third of its number annually, and receives from the second lot of ewe hogs its proportion of young stock. By this contrivance, the ewes can be sorted into three kinds: what approaches to tenderness is sorted down to the single herding, No. 8; what is open in the staple, or inclined to be pinny in the fleece, are haifed below the double shepherd's house; what is bad skinned, above it. By keeling, or marking with red chalk, the hardiest tups to No. 8, the saddest skinned to the under end, and the loftiest and most open skinned, to the upper end of the double herding, the whole flocks are kept in that medium, betwixt the two extremes, which every

* A piece of coarse cloth sewed on across the root of the tail, and about six inches down each hip on either side of the tail.

store-farmer knows to be essential to good farming, and to the sale of that quality of stock and wool that brings the greatest *sum* of money out of the market.

Tups.—In treating of the wedder sheep, allusion was made to the necessity of possessing well-bred Cheviot sheep: this, in the writer's very humble opinion, is a condition absolutely required for the purpose of realizing the greatest possible value from Sutherland mountain ground.

The reporter has seen tups very showy to look at from a distance, and full of wool; but on approaching them more nearly, the observer must have been struck with how the feet were quite under the carcass, the breast and twist much narrower than to all appearance was compatible with so broad a carcass; with a hollowness or flatness betwixt the eyes, some bristly hairs on the forehead, and very likely an offer to produce a stubby horn; of which the point, like a small nipple, is just discernible where that ornament grows on horned sheep; and, on the whole, the head turns out to be larger than at first sight it was thought to be. Touch him, and you will find a flat neck, narrow hard shoulder, small tail, flat rib, and the back, where the ribs strike out, hard as a deal board; he has very little layer or wool along the back, but (if in condition) exhibits a mass of grease and wool midway down the rib; while he will clip at a show from ten to fifteen pounds of wool, of the quality of hemp. This class of sheep is the parent of shotts; his progeny will pay nothing to the breeder, feeder, or butcher, compared with the truly bred Cheviot sheep.

Upon which then these three questions arise—Where is this truly bred Cheviot sheep to be found? How chosen? And how shall his blood be best infused into the flock? These are questions which the reporter will answer with diffidence, being conscious that many breeders are much more capable than himself to answer them satisfactorily. Still the Society having done him the honour to call for *his* report, he will send his opinion and his practice together, and will feel too happy to have them amended in any particular.

I.—The breed of Cheviot sheep from which he has chosen, and would again choose his stock (were that to do), feed on the Scotch side of the Cheviot Hills, and along the tract of high and stony moorland farms which stretches out betwixt that mountain range and the source of the Teviot: on the English side there has been, generally speaking, too much of Dishley blood applied, to have left in the animal the thrift, courage, and constitution necessary for the wastes of the county of Sutherland. West of the Teviot, again, it is within the memory of man since the stock was crossed in, from the *ovis aries rustica*, or black-faced sheep—a cross, of which the first is the best, as is the case in all crosses betwixt animals so entirely different from each other.

The spirited farmers of the western district have, for many years, been importers of tups from the east border; and the circumstance has not, perhaps, in every case, been favourable to the flock from which the importation was made. When this trade began, the west-country breeders fancied sheep with very fine bare heads, flat clean bones, and a short fine fleece, to counteract, as quickly as possible, the opposite qualities of their own flocks. In order to suit the market, the tup-breeders preserved only the finest of their young store. But the west border gentlemen had not gone through many generations, when they found that the cross had been too quick: a reaction followed, and, to the surprise of the tup-sellers, the top was turned to the bottom, the bottom to the top of the fair, and nothing could be sold but tups of coarse quality. The tup-breeders turned with the

tide—a few to an extreme degree; many stopped short at the *certos denique fines*, where good management ends: and, certainly, the right stuff, and the most beautiful specimens of well-bred Cheviots, are only to be found in this quarter.

II.—As to the choice of a tup. After Mr. George Culley's description, which is in the hands of every breeder*, it would be presumptuous in the writer of this report to say more on that subject than respectfully to point out the shades of difference betwixt Mr. Culley's picture and the quality thought to be suitable to the county of Sutherland:—

1st. His head ought not to be so very fine and small, but the nose should be full and aquiline from the tip (where the orifice is jet black) to the forehead. The brow should be inclined to be long and narrow, covered with short, white†, flat-growing, swirling hair. This cover ought to begin at the tip and extend over the whole head to the back of the crown, *close* behind the ear, where it is cut off, at once by the circle of clean, soft, thick-set, and rather boardy wool, which terminates the fleece.

2d. The junction of the neck to the head must not be so very fine, nor the top of the shoulder too broad, but a rapid increase of strength from the top of the neck to the withers or junction of the shoulders; the top of the shoulder ought to be to the touch, as if the flesh on the chine overtopped the shoulder. This flesh or layer should be deep in quality and well covered with close-set wool, to cover the back broadly and effectually to the cleaving on the tail head, where the spine terminates in a broad tail, set on so low that the eye, in returning along the back, fancies there is a gradual rise from the tail to the neck, and a little swell on the loin.

3rd. The skin ought to be by no means thin, and the wool should be thickly planted on it, fine, soft, slightly inclined to be boardy, hanging together in regular staples from root to surface, elastic to the gripe, and covering the belly, and also the quarters as far as the mutton extends; at the termination of which it is cut off at once by the clean white hair that covers the legs.

The whole animal exhibiting greater strength, daring, and agility, than Mr. Culley's description brings before the mind.

III. In breeding tups, the general practice in the highlands, after selecting the tups thought to be the best, is to shed off from each hirsel of ewes a certain number of what are considered the 'truest,' and most perfectly formed; to put one tup to each lot so shed off, and set apart; to bid the shepherd tend this lot during the 'riding' season separate from the rest of the flock, and from the produce to select tup lambs. It many years ago

* Mr. Culley's description of the ram:—'His head should be fine and small, his nostrils wide and expanded, his eyes prominent and rather bold or daring, ears thin, his collar full from the breast and shoulders, but tapering gradually all the way to where the head and neck join, which should be very fine and graceful, being perfectly free from any coarse leather hanging down; the shoulders broad and full, which must, at the same time, join so easy to the collar forward and chine backward as to leave not the least hollow in either place; the mutton upon his arm or forethigh must come quite to the knee; his legs upright, with a clean, fine bone, being equally clear from superfluous skin and coarse hairy wool from the knee and hough downward; the breast broad and well formed, which will keep his forelegs at a proper wideness; his girth, or chest, full and deep, and instead of a hollow behind the shoulders, that part, by some called the foreflank, should be quite full; the back and loins broad, flat, and straight, from the waist; the ribs must rise with a fine circular arch; his belly straight; the quarters long and full, with the mutton quite down to the hough, which should neither stand in nor out; his twist deep, wide, and full, which, with the broad breast, will keep his four legs open and upright; the whole body covered with a thin felt, and that with fine, bright, soft wool.—*Culley on Live Stock*, p. 103 and 104.

† Many very excellent Cheviot sheep have a grey colour on the nose, which gets darker near the tip. Others have a slight tinge of lemon colour on the face.

occurred to the writer, that in this method there were many defects: first, the separation intended was not effectually maintained—during the long moonlight nights of November and December the ewes got back to their accustomed haiff, and the tups mingled in the flock;—secondly, it caused a great additional disturbance to the flock, both at riding-time, and at the subsequent lambing, cutting, clipping, and speaning, to say nothing of the loss occasioned by the fox, eagle, cat, martin, raven, &c., all of which could be more cheaply fed in some other way than on tup lambs;—thirdly, in the course of his observation it occurred to him that a great proportion of the ewes so set apart in the several hirsels formed no proper cross to the tup employed in that particular hirsel, but possessed a tendency to the same defects, and to the same perfections possibly with the tup; consequently, the defects on both sides were aggravated, and the very perfections, by increasing to excess, became defects;—and, lastly, as all breeders know that animals in very many cases, and especially where crossing has taken place, breed back, not to the immediate parents, but possibly to the great-great-grand-dam or sire; it must follow that, without a particular genealogy of tup and ewe, the object intended to be effected by any particular union will often turn out contrary to the wishes and expectations of the master. It was resolved to make a careful selection from the *élite* of particular families in his own flock; to purchase, at whatever expense, a few of the *élite* of certain ancient and well-bred flocks in the east border; to form them into one 'selected hirsel' for the breeding of tups; to place them under his own immediate notice, to study the particular tendency of each family towards a deficiency or excess in each particular 'point;' by judicious crosses betwixt the various families to produce stock more perfect than either dam or sire; and through this stock to infuse the best border blood into his flocks. The experiment wrought like a charm, and in a few years it lifted up the reporter's stock to a new position, both at the tup shows, and, what is more to the purpose, in the market where the stock and wool are annually sold.

The most choice lots of the county of Sutherland wool and sheep are generally sold in the 'great annual market,' held at Inverness, in the second week of July. At this market farmers assemble from all parts of the highlands; they are met by wool-staplers and sheep-buyers from the south of Scotland and from Yorkshire, and transactions to a very great amount take place without show of stock or sample, resting entirely on the character held in the market by the owner and his goods; and it is very seldom that one hears of a disappointment occurring to buyer or seller. The market is advertised to take place on Thursday, and the business certainly might be despatched in one day; but gentlemen who find themselves removed for a time from residences which, though comfortable and beautiful, are yet solitary, when congregated with the brethren of their profession, under agreeable circumstances, can seldom be induced to separate before the conclusion of the week. The weekly steamers betwixt Inverness and the Forth and Clyde, and the daily coaches betwixt the same city, Edinburgh, Aberdeen, and Glasgow, afford such facilities, that an English farmer, by embarking at Yarmouth or Sunderland on the east coast, or at Liverpool on the west, might attend this market at the expense of one fortnight's absence from his home.

Accounts.—The farm accounts are kept in the most simple form possible, by journal and ledger, checked by double entry, vouched by the steward's reports and other documents, and abbreviated by five waste-books. The waste-books, consisting of a corn-book, cash-book, sheep-

book, time bill-book, and jotter memorandum of statements with work-people, are carried on from week to week throughout the year, and at its termination the whole posted from these through the journal into the ledger, which is shut by a balance account on the 1st January yearly. Farmer's books are not such agreeable companions now, as they were before the battle of Waterloo; nevertheless, a wise man will keep them correctly, and balance them punctually; recollecting that it is in the rout, not the fight, that the carnage takes place, and that that party is safest which shows the most correct front to the enemy. When a farmer's accounts betray confusion or sloth, his servants become indifferent to their duty; faithful servants quit, worse men take their places, and pillage begins. A rogue is shy to engage with a master who pays punctually and liberally, with a professed intention fearlessly to send the thief to justice. He waits for a place of a contrary description, and there he exercises his vocation.

Capital.—According to the best opinion which the reporter can form, the capital necessary to enable a farmer to carry on business in Sutherland may be stated at about four pounds to four pounds ten shillings per tillage acre, and twenty shillings for each sheep. A Scotch farmer, however, under a decent landlord, may venture farther than would be safe in other circumstances, in consequence of the landlord's right of hypothec, or preference established by Scotch law over the whole produce of the farm in security of his rent. This right of preference exists, tacitly, over each crop for the rent of that crop, and over all stock until three months after the last conventional term of payment. Suppose a tenant's rent payable, by equal portions, at Martinmas 1829, and Whitsuntide 1830, for crop and year 1829. At Martinmas, markets for corn, and, at Whitsuntide, markets for stock, are ruinously bad, in consequence of the glut caused at these seasons by the distress of the English farmer. The Scotch landlord, *knowing the perfect nature of his security*, scruples not, in such circumstances, to give his tenant whatever indulgence is necessary for the fair conversion of his produce into money. The difference of five, ten, fifteen, or twenty per cent. on the gross sales of his farm is an important one. Neither is such an exercise of the landlord's right attended by any bad consequences to society; diminishing, in the first place, the glut of markets at term time, it slackens at another season the gripe of the forestaller, and softens the monopoly which he would otherwise be possessed of; secondly, the dealer who buys farm produce, knowing perfectly the *public law of the land*, feels himself at liberty, before settling with the tenant, to say, 'I presume your rent is paid?' The answer from the most necessitous man is, 'Indeed, Sir, it is not, but here is a letter from my landlord or his agent, to say that you may pay me 50*l.* on account, and for the balance he and I will grant a receipt in full.' By a judicious exercise of this right of hypothec during the late difficult years, thousands of Scotch farmers have been saved from ruin; and men are now prosperously conducting the operations of a farm, who, in other circumstances, must have sunk under the pressure of those times which have overwhelmed so many of their brethren in the south.

Those who disapprove of the right of hypothec say, 'Let the tenant find personal security to the landlord, if he cannot pay on term day; or let the landlord at once take an execution for his rent.' But it is submitted that it would not be wise to recommend the substitution of an execution for the existence of the landlord's *tacit* right of hypothec; and with respect to security, where is he to find it, but among persons in circum-

stances similar to his own, to whom and with whose friends he must join in obligations of the same nature? In the extent and uncertainty of his engagements his head turns, he plunges into one or more of the fatal circles which from three months to three months revolve round the banker's counting-house; and after increasing, to the best of his ability, the revenue derived from the 'Excise,' and thereby proving the 'prosperity' of the country, down he comes.

POOR.—Another instance of Scotch feeling the reporter will notice, as it exists among a different class—the cotter or agricultural labourer—that is, with respect to poor-rates. The English, the bravest and most generous people in the world, have established them; and yet it is not said that they are anywhere so established, unattended by a considerable degree of improvidence and dissipation among the parties in behalf of whom the provision is made.

On the demesnes of which these farms are a portion, with a more dense population than ever existed there at any former period of time *, there are no tithes, no poor-rates, and—no drunkards, or beggars; positively few or none, besides the Irish, and the few squalid, ruined men from the south, who wander occasionally into the country. Nay, one meets with few peasants' sons, of this district, who have not, from such slender wages as this report speaks to, been taught to read, write, and, perhaps, to cast up an account. If a tolerable proficient, away he goes to 'seek his fortune;' and the proverb says, 'It is a bare moor but he will find a cowe† upon it.' Go where he may, his heart is with his father's house; and if he succeed in life, which he generally does to a certain extent, the 'inmates' there are the better for it. The first feeling of a Scotch peasant is affection for his kindred; the second is his sense of *their mutual* but sole dependence, under Providence, on industry and thrift, to save them from the shame of beggary. The parent wrestles hard to push forward some part of his family by dint of education: the child, unknown to any,

'deposits his sair won penny fee,
To help his parents dear, should they in hardship be.'

By reciprocal good offices, by joint industry, sobriety, and prudence, they get on wonderfully. In sickness they apply at the nearest house where any medicine or comfort is likely to be obtained for their friend in distress: they seem to expect it as a debt, or rather a loan, due from one Christian to another: but for the least drop of honey, jelly, wine, or even vinegar obtained, there is a visit from the patient, as soon as he can crawl abroad, with a thousand thanks, and a fowl, some eggs, or the like; which how to refuse or to pay for without offence it requires some tact to discover.

On entering the habitation of the cotter, his fare is found to be very simple. In summer, oatmeal porridge with milk for breakfast, potatoes for dinner, and bread and milk or something similar for supper. In winter, porridge, with perhaps a little bit of butter or some treacle, to breakfast; potatoes mashed, cut into slices, and done on the gridiron, and eaten with a very little fish, pork, or a bit of cheese to dinner, and gruel with a few potatoes or a bit of oaten or barley bread to supper. His abstinence is nearly complete from tea, coffee, sugar, candles, soap, ale, parliament whisky‡, and every taxed commodity, except tobacco; and the nature of the climate has rendered it one of the necessaries of his life.

* Vide census, 1811, 1821, 1831. † Cowe, a bit of heather.

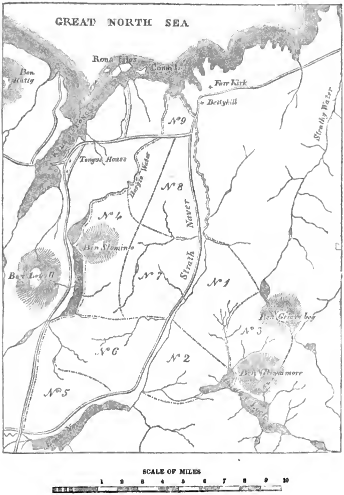
‡ Within these few years illicit distillation has almost entirely disappeared, and the character of those that dealt in it has proportionally improved.

To a greater share of the comforts of life, the agricultural working man and his family may, doubtless, be admitted, and are so daily; but prudence and care and moral conduct continue, and it is hoped will long continue, to characterize this simple, industrious, and virtuous class of men.

PATRICK SELLAR.

Morvich, 6th January, 1831.

PLAN OF PART OF MR. SELLAR'S FARMS.



DESCRIPTION OF A FARM IN THE WESTERN EXTREMITY OF EASTERN ROSS, ROSS-SHIRE.

PRESENTED BY MR. JOHN BAIGRIE.

This farm, consisting of about four hundred imperial acres, was, prior to 1825, occupied by numerous small tenants, who farmed the land on the old system which prevailed in the Highlands of Scotland about fifty or sixty years ago—viz., the continued occupation of the ground by some description of corn crop, with exception of the small portion allotted for potatoes.

Their rotation—if rotation it may be called—consisted of oats, chiefly of the dun or black variety, which were continued to be sown in the same field in many instances for five or six years, or so long as the produce yielded two returns. When thought sufficiently exhausted, a portion was then manured in the spring for bear or bigg, and for potatoes—succeeded again by oats, which were continued until the effects of the dung were no longer visible, when the land was allowed 'to rest'—*i. e.*, to remain unploughed for a period of years, producing nothing but weeds, with a small portion of indigenous grasses, no artificial seeds being ever sown.

The arable land of this farm was detached in small patches of from two to three acres, interspersed with considerable tracts of brush-wood and uncultivated ground, on which stones, which have for centuries been collected from the land, have been allowed to lie. In addition to this accumulation of smaller stones, large masses of blue granite lay amongst the arable ground, above and immediately below the surface, so as to offer considerable interruption to the plough. The land was besides in a very wet state from the many springs issuing out of it, and there being no drains nor ditches to carry them off. So much was this felt in some seasons, that it was frequently the month of May before any corn was sown.

Such was the state of the farm in March, 1825, presenting serious obstacles to improvement, but at the same time possessing capabilities which could not be overlooked, and which promised ample remuneration for the expense proposed to be incurred.

As the farm which forms the subject of the following remarks was, at the period alluded to, almost in a state of nature, the writer, in the hope it may prove useful, proposes giving a detailed account of the various operations connected with its improvement.

The farm lies on the slope of a hill and facing the south, and consists of two varieties of soil. 1st—A clay loam of from twelve inches to two feet deep, chiefly upon an open gravelly subsoil. 2d—Gravel mixed with a large portion of black mould from six to fifteen inches deep, also on a pervious subsoil.

Possession of the arable land having been obtained in the spring of 1825, in consequence of the right to the sowing of the crop of that year by the former tenants having been purchased from them, as well as the manure they had made from the previous crop, operations were commenced on the farm in the month of March. The first object was to lay off the arable land, as well as what was intended to be trenched, into fields of a regular shape, varying in size from twelve to twenty-five acres, according to circumstances, when such of them as could not be taken in hand in one season were sown with oats so far as the arable land extended. One field was selected for turnips and another for fallow;

but from the scarcity of manure, in the first season, the sowing of both wheat and turnips was necessarily confined to a small scale.

Draining.—As draining was evidently the first necessary operation, a number of labourers were employed for that purpose, who executed the work by the job or piece. The drains were cut from three to four and a half feet deep, according to the nature of the substratum; two and a half feet wide at the top, and sixteen inches at bottom—the width at the top varying in proportion to the depth. Stones were then put in to the height of thirty inches, an opening of six inches square being left and built in the bottom to prevent the sides of the drain from falling in, and thereby impeding the running of the water. Above the stones a covering of dried weeds, gathered from the land, was laid, to prevent the mould from mixing with the stones; after which the drain was filled up, taking care to throw in the subsoil first. The expense of opening and closing was twopence per ell of thirty-seven inches, and a halfpenny per ell for carting the stones, making the whole expense of the drains threepence per lineal ell. This sum appears a low price for the work, but an expert labourer, although he should require to use the mattock to gain twelve inches of the depth, will, at that price, earn from two shillings to half-a-crown per day.

Blasting Stones.—While the draining was going on, men were employed to blast the large stones, some of which lay on the surface, while others showed only a small portion above it, and many were not discovered until the field had got the first ploughing. These stones, the greater number of which would weigh several tons, were blasted with gunpowder to a size which would enable two men to lift the pieces into a cart. Such of the stones as were below the ground, or had a part only buried, the contractor for the blasting was bound to clear around them, *i. e.*, expose the whole of the stone to view, for the reason that, when the stone exploded, it might have room to fly asunder. When this operation is neglected, much labour and expense are lost. The expense of boring, blasting, and clearing the stones, including gunpowder, was fifteen pence per foot of bore, but latterly, by competition, was reduced to a shilling per foot. Many stones required thirty feet of bore to reduce them to a size fit for building stone fences, to which purpose they were to be applied.

Trenching.—As the two fields intended for turnips and fallow contained several acres of uncultivated ground, chiefly covered with hazel, alder, and birch wood, these were trenched by the spade to the depth of sixteen inches, turning up all the stones except those requiring to be blasted. The draining and stone fences going on at the same time, these stones were immediately carted off; the large to the fences, and smaller ones to the drains. The expense of trenching varied considerably, according to the hardness of the soil, quantity of stones in it, and thickness of the brushwood: in general, where all these prevailed, the expense was fourteen pounds per acre; when not covered with brush-wood, eleven pounds per acre.

Fences.—On one side of a field in which drains were cut, a ditch was usually formed, both as a fence and as a conductor of the water from the drains, in one side of which a hedge was planted, formed of a single row of whitethorn, paled on that side to protect the hedge until it should be able to protect itself. The dimensions of the ditches are, seven feet wide at the top, three and a half feet deep, and eighteen inches wide at the bottom. The expense, including the setting of the thorns, was sixpence halfpenny per ell.

It has been found from experience that where there is a considerable fall in the ground, as on the farm described, the ditches which follow the slope of the hill should have been causewayed in the bottom, to prevent the injury done to them by the winter floods. This might have been done at a comparatively trifling expense before the small stones in the adjoining fields had been otherwise disposed of.

Where ditches were not necessary for the purpose of carrying off water, dry stone dykes or walls were built, both as being the preferable fence where cattle or sheep are pastured, and for the purpose of using the stones which were procured from the trenching and blasting. These dykes are three feet at the base, and carried to the height of four and a half feet of built work, tapering at the top to a breadth of ten inches, and topped above all with a Galloway coping, or stones placed on edge, of about ten inches high, making the whole height five feet four inches. The expense per lineal ell, including the driving of the stones, which the contractor for the dykes generally performs, ran from ten pence halfpenny to a shilling. The stones, however, were near at hand, which enabled the work to be so cheaply executed, and grass was found for the contractor's horses on the unimproved ground. The price for building is sixpence per ell, and the difference was allowed for the carriage of the materials.

Preparation for Turnips.—The field already alluded to, which was intended for turnips, being sufficiently drained, and the stones and brushwood cleared off from the arable and trenched land, so many ploughings and harrowings were given as were necessary to clean the field from quickens or root weeds, which were, after each harrowing, carefully hand-picked. The first three ploughings were not made deep, the more effectually to bring up the weeds; but after the cleaning process was ended, the land got a very deep furrow.

Liming.—The land of the farm described being generally of a rich and deep quality, but containing no calcareous matter, it was considered that the application of lime would be attended with beneficial effects, and the result has exceeded the most sanguine expectations. It being well known that lime acts more powerfully on new soil than on land which has been long in cultivation, it was desirable that some fresh mould should be taken up to mix with the old soil before the lime should be applied. For this reason a deep furrow, as already mentioned, was given to the land. Some persons for this purpose use four horses, but as those on this farm are very powerful, and the land not being of a cohesive nature, two were found competent to the task. The lime, which was all imported from Sunderland, was landed about four miles distant from the farm, and when carted to the field was laid down in a long heap or mound contiguous to water, if possible on one side of the field on which it was to be applied. Two labourers are then employed to turn the lime, and a third waters it. When the whole has been gone over, it is allowed to lie for four or five days, when it is again turned, and if any part of the lime should be found to be still unslaked, more water is added.

This mode of slaking lime is considered preferable to the very common one of laying down the lime, as it is taken from the ship or kiln, in small heaps on the land, to be slaked by the atmosphere, or by the moisture of the soil, which, in dry seasons, is thrown upon it. By the former method every particle of the lime is reduced to a powder, which seldom happens the other way. The only advantage attending the latter mode is, that the quantity per acre can be more correctly applied; but any one who has had experience of the method recommended, knows from the appearance

of the lime on the ground whether it be above or below the intended quantity. It is apprehended the more effectual slaking of the lime, and consequently the more equal distribution of it on the land, more than compensate for the additional labour of turning, watering, and carting it out. The quantity per acre applied to the field for turnips was one hundred and eighty bushels. When the whole lime has been spread on the land from the carts, the field gets one turn of the harrows, both for the purpose of mixing the lime with the soil, and to prevent any of it from being carried off by high winds.

Turnip Sowing.—At this stage the drilling for turnips commences, the drills being made twenty-seven inches apart, when the dung, which had been previously carted to the field and well fermented, is laid in the bottom of the drills, taking great care that it is regularly spread. This is of greater consequence to the success of the crop than is generally imagined.

In this instance no more than nine tons per acre could be allowed, as no other manure could be procured; and bone dust, now so generally and successfully used, was not known here at the time.

Sowing commences about the 8th of June, and continues till the end of the month, and is performed with a double drill machine in the usual way. The kinds of seed sown on this farm are field yellow, green topped white, and white globe, commencing with the yellow and finishing with the globe. Swedes were obliged to be discontinued, as the hares are so numerous as to destroy them before the season arrived when that valuable root is generally used. They could have been taken up and stored, but their quality would have been injured by long keeping. The yellow, which grow to a greater size than the Swedes, supply their place, as they stand the frost nearly as well, although their quality is deteriorated earlier in the spring, on account of their greater tendency to shoot.

The produce of the field first improved was very great; but as no portion of it was weighed, a correct estimate of the crop cannot be given—it considerably exceeded in bulk any crop the writer ever saw on old improved lands. This may be accounted for from the circumstance of a turnip crop being new to the soil, and from the application of lime to the fresh mould taken up.

Fallow for Wheat.—As the greater part of the dung purchased from the former occupants was applied to the turnip field, eight and a half acres only could be manured for wheat.

In the cleaning process the treatment was in every respect the same as in the turnip field. As the land is deeper and rather more compact, it got two hundred bushels per acre of lime, and about twelve tons of farm manure, both being applied immediately before the last or seed furrow.

Wheat Sowing.—The seed, which was procured from a chalk farm in Kent, was of the white sort, and was sown about the middle of September, at the rate of three and a half bushels per acre.

Produce.—The eight and a half acres of wheat yielded the very great return of forty bushels per acre; and it may be mentioned that the last crop of oats which the same land produced to the former tenant, was so bad as scarcely to pay the expense of cutting it down.

In the following year a small field of twelve acres, treated in every way like the former, with this important exception, that it got no manure, produced thirty-six bushels per acre.

These great returns may be ascribed principally to the operation of the lime on a deep and naturally rich soil, to which no calcareous manure had

ever been previously applied. But as the peculiarly fine season of 1826 must have had considerable influence on the productiveness of the crops of this farm, which is situated considerably above the level of the Sea, it must be mentioned, that in no subsequent year did the crops yield so much, although the bulk on the land was frequently greater.

In the manner already described the improvement of the other fields was conducted until the whole farm had been gone over, which was nearly effected in November 1828, being little more than three years and a half since operations were commenced. It being an object with the proprietor to carry on the improvements with all possible dispatch, a considerable number of labourers were consequently employed, which caused the improvements to be completed in little more than half the time that in ordinary cases would have been necessary.

It must be here stated, that, although from the scarcity of manure in the first season, the number of acres sown with turnips and wheat were necessarily very limited, other improvements, as trenching, ditching, inclosing, &c., were proceeding on a large scale.

It added in no small degree to the labour, that, during the period alluded to, upwards of fifty thousand bushels of lime were carted a distance of four miles to the farm, on a road of considerable ascent, and without any assistance from hired carters.

Establishment.—The farm, during the continuance of the improvements, was worked by a bailiff, six ploughmen or carters, and three labourers, in constant pay, and six pairs of horses; but as a considerable portion of the farm is now kept in grass, and two fields in permanent pasture or meadow, the number of horses is reduced to four pairs and a supernumerary horse.

Expense of Improvement.—As it may be satisfactory to give an idea of the expense of the improvement of some of the fields, two are selected; the one the most expensive, the other the least so. But it must be observed, that in stating the items of expense, no price is put upon the labour of the farm horses in carting the lime, fallowing, &c., which would at least come to five pounds per acre.

21-Acre field.	Blasting large stones	£75	0	0
	Trenching, 6½ acres, at 12*l*. 10*s*. per acre	81	5	0
	Drains	3	0	0
	Lime, 3024 bushels (144 bushels per acre), at 6½*d*.	81	18	0
	Inclosing with stone dyke	52	7	0
	Average, per acre, 13*l*. 19*s*. 6*d*.	£293	10	0
12-Acre field.	Blasting large stones	£8	16	5
	Trenching	4	0	0
	Drains	0	15	6
	Lime, 2304 bushels (192 bushels per acre), at 6½*d*.	62	8	0
	Ditch for intercepting hill water	7	10	7
	Average, per acre, 6*l*. 19*s*. 2*d*.	£83	10	6

This last field is that alluded to as having yielded thirty-six bushels of wheat per acre after fallow without manure.

Rotation of Crops.—All the fields on the farm having been gone over in the manner already described, the previously exhausted state of the land, from a continued course of bad farming, rendered it necessary

that, in the first round of cropping, it should be allowed to remain in grass for two or more years, for the purpose of recruiting its strength. With that view each field, as improved, was sown down with red and white clover and perennial rye-grass, in the proportion of eight pounds of red clover, four of white, and one and a half bushels of rye-grass per acre.

An easy rotation, or such as would least deteriorate the soil, was therefore fixed on, and is now followed, On that part of the farm, consisting of a deep clay loam, the course commences with—1. Fallow, a small portion of potatoes and spring sown tares. 2. Wheat sown down with grass seeds. 3. Clover. 4. Pasture. 5. Oats.

On the lighter division the rotation is—1. Turnips. 2. Barley, with grass seeds. 3. Pasture. 4. Pasture. 5. Oats. It is probable that this may be the course of cropping which will continue to be pursued. A more profitable one could be adopted by extending the course, and introducing beans, succeeded by wheat, into the rotation; but as the farm, as already mentioned, is situated considerably above the level of the sea, and in the immediate neighbourhood of high hills, the bean crop, in most parts of Scotland a precarious one, would, in this situation, be doubly so; and the further extension of wheat would also be hazardous.

Farm Offices.—These are conveniently situated, being nearly in the centre of the farm, and are of the most approved construction, possessing ample shed room for cattle, granaries, &c., and have a water threshing-machine of eight horses' power attached.

Roads.—Besides a county road, which bounds the farm nearly its whole length, there are cross roads, which intersect it at convenient distances.

Sheep Walk.—Connected with the arable farm described, there is a range of moor ground, interspersed with valleys of green pasture, on which fifteen hundred sheep are kept of the pure Cheviot or white-faced breed.—Surface draining being much wanted in the valleys, many thousand ells of drains were cut, which have had the effect of increasing the quantity and improving the quality of the pasture. The dimensions of the drains are twelve inches deep and twenty inches wide, and are executed at a farthing per ell. The sod that is cut out is carefully placed at the edge of the drain, with the grass side up, to preserve the green sward. The sheep walk, in consequence of its being joined to the arable farm, has the advantage of superior wintering for the hogs or lambs, on account of the green food and shelter afforded by the woods that are attached to the farm. As the wedder lambs are annually sold, no turnips are given to the ewe lambs, but in lieu of them they are allowed the range of the clover stubbles, which has equally the effect with turnips of checking braxy, a disease that often carries off a large portion of the flock where clover stubbles or turnips cannot be obtained, laxative food being the only preventive hitherto discovered. The sheep are managed by a head shepherd and a boy.

General Character of the District.—The district of Eastern Ross consists of soil of all the varieties of loam, from a rich deep clay loam to light sandy loam; and as the climate of the lower parts of the district is favourable for raising wheat, that grain is cultivated to a considerable extent, and the quality in general is fine. In a few instances the wheat from one farm has brought the highest price in Mark Lane.

On the first-mentioned soil the system of cropping is as follows:—1. Fallow and a small portion of turnips. 2. Wheat sown down with grass. 3. Clover. 4. Oats. 5. Drilled beans, potatoes, and spring-sown tares. 6. Wheat.

On lighter loams the rotation is—1. Turnips eaten off with sheep. 2. Spring-sown wheat. 3. Clover. 4. Oats. 5. Beans, &c. 6. Wheat; and on the light sandy loams the mode of cropping is—1. Turnips eaten off with sheep. 2. Spring-sown wheat and barley. 3. Clover. 4. Pasture. 5. Oats.

Advantages of Eating off Turnips with Sheep.—The farmers of the second and last mentioned soils derive very considerable benefit from the neighbouring county of Sutherland. In that county sheep farming is carried on systematically, and on a very extensive scale; and it forms part of the system to winter on turnips the wedder hogs or lambs of that season, as well as the weaker part of the stock. As the turnips raised in the county are not adequate to feed the proportion of hogs from an aggregate stock of 156,000 Cheviot sheep, together with the cattle reared in the country, the farmers have recourse to this district and to Ross-shire generally, to make up the deficiency. The consequence is, that many hundred acres of turnips are annually taken by the Sutherland farmers in this county, the advantages of which to the district are obvious, as the land on which the turnips have been eaten by sheep is so enriched as to enable many farmers to grow wheat where otherwise it would not be attempted.

It is the general practice to draw off one half of the turnips, taking every alternate drill, to give to cattle in the straw yards. This is required both on account of the necessity of converting the straw into manure, and to prevent the land, where otherwise in good condition, from being over enriched by the sheep.

Another reason may also be stated. As it is only after turnips that wheat, on such soils, is raised, it is important to have the field cleared before the 10th of March—the latest period, in this district, at which wheat is sown in spring.

The raising of wheat on light sandy soils has thus become a practice where, not many years since, it was unknown; and, as that grain produces more straw than any other, and consequently more dung is obtained, a greater breadth of turnips is the natural result.

Size of Farms.—The size of the farms in the district is, of course, various, depending on the extent of capital of the tenants; in general they run from two to four hundred imperial acres. The best description of lands let as high as two pounds per acre, while the inferior sorts are as low as fifteen shillings.

Very few cattle are fatted for the butcher, as the small towns and villages afford a limited consumption; but a spirited farmer from the south of Scotland, who rents two extensive farms in the district, has for several years been in the habit of feeding a considerable number of sheep, which he drives, a distance of about two hundred miles, to the Edinburgh market.

This tedious land journey will soon, it is hoped, be rendered unnecessary, by the adoption of a mode of conveyance to be afterwards noticed.

No dairies are kept, as, on account of the great distance from large towns, it is found more profitable to rear cattle on farms where a considerable portion is kept in pasture.

A considerable number of cattle are reared in the district, but as these are not sufficient for the consumption of the winter keep, the additional numbers are supplied from the Highlands of Sutherland and Ross-shire.

Almost all the farmers rear their own horses. At an earlier period, and before good stallions were introduced into the country, the local farmers' societies offered premiums for the best horses from Clydesdale

and other southern districts of Scotland; but of late years, good stallions are annually sent north without any other encouragement than is afforded by the number of mares they obtain. A few are bred and kept in the country, but they are generally of inferior stamp.

On well-regulated farms, where the working stock are kept in full employment, it is usual that the ploughmen or carters do little other work than that in which their horses are engaged. All other work is performed by labourers, either by the day or by the job; the latter, in all cases where the nature of the work admits of it, being the preferable mode of employing them.

Method of working and feeding the Horses.—In the spring and summer months the horses are worked ten hours per diem. The ploughmen are in the stable a little after four o'clock, A.M., to clean it out and to dress and feed their horses. They are ready to start at five; between seven and eight their breakfast, consisting of porridge and milk, is sent to the field, and after a few minutes, they are again in motion. At ten the horses are unyoked, and remain in the stable until two, when they again start for the afternoon yoking, which lasts until seven.

These hours of working are considered the best, as the horses are at rest and feeding during the heat of the day. In the interval, the ploughmen, by turns, cut clover or tares for the horses, which are carted home by a supernumerary horse that is generally kept for that and other purposes. During hay-time and harvest, or when the corn is carrying, no specified hours of working the horses are kept. In winter, when the weather admits of it, the horses are in the yoke, except an hour and a half in the middle of the day, as long as there is daylight.

The mode of feeding the horses varies according to the ideas of the farmers, but the general method is as follows. During the spring months they get one feed of oats in the morning at ten o'clock; when they come in to the stable they get a mash of boiled light grain and turnips. Before they start again at two, another feed of oats is given, and when they cease working at seven the mash is repeated. Some farmers substitute Swedish or yellow turnips for the mash of boiled grain, which is found equally to answer the purpose of keeping the horses fresh, and in a good working state.

In summer, when the horses are fed on cut clover or tares, it is not usual to give them oats, as, unless they are bruised, a practice not sufficiently attended to, it is not supposed they could be much benefited by them. In the winter months the horses get one feed of oats in the morning, and either mashes or raw Swedes in the forenoon. At eight, P.M., they are dressed and littered, and get a repetition of the mash. When there is much carting, as in driving lime, &c., the quantity of oats is increased. Hay and bean straw form the rest of the food; and as there is little demand for the former, it is probable the horses get a larger proportion of it than they would otherwise obtain. Hay or straw-cutting does not prevail here as in England.

General Remarks.—Improvements, such as practised in the south of Scotland, commenced in this county about the beginning of the nineteenth century, previous to which period judicious management was followed only by the more enlightened proprietors on their home farms. A few of the respectable native farmers studied agriculture in the improved counties in the south of Scotland, and the example which they showed in the improvement of their farms was gradually followed by their neighbours.

The rent of lands in the southern districts having considerably advanced at this period, induced farmers from these quarters to look to this county. The proprietors being sensible of the advantage that might be expected from the example which they would set to their other tenantry, granted leases considered at the time mutually beneficial in regard to enclosures, &c. &c. These men immediately commenced the improved system of fallowing and sowing turnips, &c., and brought with them superior implements of husbandry. Although not uniform in their success, from the circumstance of their taking farms of an extent beyond their capital, by which a few became bankrupt, the native farmers saw the success of a portion of them, and observed that their crops of wheat, beans, &c., were brought to maturity. They also perceived the great superiority of their management in having turnips for their cattle in winter, by which so much additional manure, and of better quality, was produced, and the cattle kept in a growing, healthful state, instead of being, as by their own system, kept barely alive during the winter months.

The improved mode of farming having gradually extended to the larger native tacksmen, the smaller tenants, and even the crofters, took the hint, and at this period (1831) a crofter who only pays a rent of five pounds has his patches of wheat and turnips.

The opening of the country by the Caledonian canal has materially contributed to its improvement; as, independently of what may be expected from it for the general purposes of commerce, it affords the means of transporting the wheat of this district and of Morayshire, to the Liverpool market, which of late years has been the principal outlet for that grain. This arises from the circumstance that, from the dry nature of our climate, better wheat is raised than in the west of England and Ireland. The voyages through the canal are, however, frequently tedious, as the winds, confined by the mountains, generally blow from either end, and often for long periods. This can be obviated by the application of steam, and after the very large expenditure on this great national work, the expense of this power seems quite trifling, compared with the advantages to the navigation of the canal. By the aid of Government, and under the direction of parliamentary commissioners, extensive lines of excellent roads and good harbours have been constructed. Another important improvement is on the eve of being set on foot, namely, the establishing of steam-boats for the purpose of carrying fat cattle and sheep to the English and southern Scottish markets. The benefit of this conveyance must be very sensibly felt, as the loss of weight and other casualties which fat stock experience in their tedious land journey at an early period of the year, and when food is often difficult to be procured on the road, very much lessen the profits of the feeder. The greater expense per head which the transport by steam must occasion, will, it is thought, be more than counterbalanced by the superior condition of the animals on arriving at market.

Character of the Peasantry.—Like our Scottish peasantry in general, the inhabitants of this country may be said to be religious; are of sober, industrious, and peaceable habits; obedient and respectful to their superiors; and are willing to be instructed in any thing connected with their occupation by which they can make themselves more useful.

FARM-REPORTS.

A GLOUCESTERSHIRE HILL-FARM.

COMMUNICATED BY MR. JOHN MORTON, CHESTERHILL.

"The labour of the farmer gives employment to the manufacturer, and yields a support for the other parts of the community: it is the spring which sets the whole grand machine of commerce in motion; and the sail could not be spread without the assistance of the plough. Of nations, as of individuals, the first blessing is independence. Neither the man nor the people can be happy, to whom any human power can deny the necessaries or conveniencies of life. There is no way of living without the need of foreign assistance, but by the product of our own land, improved by our own labour. Every other source of plenty is perishable or casual. By agriculture only can commerce be perpetuated; and by agriculture alone can we live in plenty without intercourse with other nations. This, therefore, is the great art, which every government ought to protect, every proprietor of lands to practise, and every inquirer into nature to improve."—*Dr. Johnson.*

GLOUCESTERSHIRE COTSWOLD.

INTRODUCTORY REMARKS.

On the Formation and General Characters of Soils.

SOIL is formed by the mixture of decayed vegetables with the surface of the earth, and is clayey or sandy, in proportion to the quantities of clay or sand with which the vegetable matter or mould is mixed. It differs from the subjacent soil or sub-soil, according to the quantity of vegetable matter which it contains; but it partakes of the nature of the sub-soil. When the soil rests upon rock, it is supposed to have been gradually formed by the decomposition of the rock on which it rests. The nature of the soil will, therefore, partake of the nature of the rock. And whether the sub-soil is rock, gravel, sand or clay, the soil above it partakes of the same nature and properties in a greater or less degree. If the sub-soil is rock, the soil partakes of the nature and properties of that rock whether it is calcareous, silicious, or clayey. In like manner, if the sub-soil is a calcareous clay, a gravelly clay, or a sandy gravel, such is the soil;—it is silicious, calcareous or clayey, as the sub-soil is. The nature of the sub-soil may, therefore, be easily known from the nature of the subjacent rock or sub-soil *.

The connection that subsists between the soil and the subjacent rock or sub-soil is, in our opinion, of great importance, and would form the best foundation for a classification of soils, as conveying some idea of the nature and quality of the materials of which the soil is composed.

Sub-soil may either be of a compact, and retentive nature, preventing the rain or water that may come upon it from percolating through it,—such as clay, till, lias, limestone, and some other kinds of rock; or it may

* An exception, however, must be made of alluvial soils, or such as have been conveyed from a distance, in the case of which the above correspondence between the soil and sub-soil does not hold—at least universally.

be of a loose, friable, and porous texture,—such as gravel, sand, and open rubbly rock. In the former case, it is easily affected by the alternations of dry and wet weather, and if near the surface, is of little value for the production of corn; in the latter, if also near the surface, the moisture of the soil is easily exhausted by heat and drought, and the plants *burn*, as it is called, or decay for want of nourishment.

A shallow soil is soon affected by the nature and texture of the sub-soil; and the greater its depth, it is the less so, and, therefore, the better calculated for the purposes of cultivation.

Soils are, therefore, affected not only by their own depth, but also by the texture and quality of their sub-soils. The best sub-soil is that which is dry, friable, and porous.

GENERAL CHARACTER OF THE OOLITIC FORMATION.

The geology of the kingdom is now so well known, and the direction and boundary of each of the formations so well defined, that a selection of farms along the line of each of the several formations, would not only be the most scientific and comprehensive mode of proceeding with giving "a detailed view of the principal agricultural systems of England," but also by far the most useful to the practical agriculturist. Were accounts given of the different modes of culture practised on the different formations, and classed together according to the individual formations they describe, the student, in search of practical knowledge, would have the advantage of being enabled at once to refer to a variety of modes of management, pursued on the same sub-soil and nearly the same soil, and to select that which might seem the best adapted to his own particular case.

The principal feature of the county of Gloucester is the western boundary of the Cotswold hills, which is formed by the outer edge of the oolitic rock. In it there are a number of recesses exhibiting a great variety of forms, and giving to the landscape of the county its peculiar character. These recesses opening into the great valley of the Severn, finely ramified, and extending a considerable way into the table land, form deep and beautiful valleys. These deep valleys, and the uniform inclination of the sides of the hills, give its beautiful and picturesque scenery to the county of Gloucester. These hills are very steep on the west side, but form a table-land, or fall very gradually on the east. On this table-land the Thames and the Isis take their rise, and wander eastward upwards of a hundred miles, before they reach the level of the tide; while in the west, the Severn, with its rapid tide, flows within about five miles of the edge of the hills, and, at the shortest distance, within fifteen miles of Thames' head. The Cotswold district is bounded on the west by the edge of the hills, and may be said to extend from near Bath to Moreton in the Marsh, varying in breadth from five to twenty miles. The sub-soil of this district being calcareous rubble, lying on the oolitic rock, (termed, provincially, Bath or freestone,) which is also calcareous, is open and dry, and readily permits the water to pass through it. The soil seems to be formed from the decomposition of the rock, on which it lies, and partakes of its calcareous nature. It is loamy, shallow, and full of stones, seldom allowing the plough to enter more than four or five inches below the surface.

The eastern side of the Cotswold is composed of cornbrash, or forest-marble, which lies above the oolitic rock, and consists of beds of limestone, generally very thin, and divided by partings of calcareous clay, lying between strata of calcareo-silicious sandstone. Its beds are thin and slaty. Sometimes, however, beds two or three feet thick may be found. It is composed of dark-coloured shells, interspersed with white oolitic

particles. It is generally used as a coarse roofing slate, and as flag-stones; but the more solid and thick beds are sometimes used as a coarse marble, being variegated by its imbedded shells.

The soil on the corn-brash or forest-marble is more tenacious in its nature, and generally of better quality than that on the oolitic or free-stone. Thin, wet clays, however, of the most worthless kind, are frequently to be met with on it, rotting sheep, if pastured on them, and seldom, if ever, repaying the expense of cultivation, if ploughed. Although the soil on the corn-brash contains a portion of silicious sand in its calcareous clay, it is of a binding and tenacious nature, clinging to the feet in wet, and baking into hard lumps in dry weather; and in continued drought, the ground is rent open to the depth of the soil. This district, in most parts, is bleak and bare; but in others affords a short fine grass for pasture, and is generally well calculated for producing the crops which the arable farmer cultivates. The same formation with its soil and sub-soil extends from Crewkerne through the counties of Somerset, Gloucester, Oxford, Northampton, Rutland and Lincoln, to Barton on the Humber, with but very little variation in its nature and quality.

The general elevation of the Cotswold hills is from 500 to 800 feet: some of them rise to the height of 1100 feet. The climate is remarkably mild considering the elevation and nakedness of the district, there being very few hedges with hedge-row timber, the inclosures being chiefly formed by stone walls.

TILLAGE.

Tillage is an operation by which the soil is intended to be pulverized, to have a new surface exposed to the influence of the atmosphere, to be cleaned from weeds, and manured, and thus to be prepared for receiving the seeds of the plants cultivated by the husbandman. The land becomes foul and unproductive, when this operation is not properly performed. Tillage, therefore, holds a prominent place in the business of the arable farmer; and the character of the crops will depend on the manner in which it is executed.

The plough, the drag, the harrow, and the roller are the instruments universally employed by farmers in executing this work; which ought to be effected in spring and summer, when the ground is dry, when the influence of the sun and air will assist the farmer in accomplishing his object, and the earlier in spring it is accomplished the better. The principal object is to keep the land perfectly clean, that none of the virtue of the soil may go to the production of weeds; for if weeds are allowed to grow, all the labour, as well as the manure, bestowed on the land will only tend to produce a greater quantity of them, and to reduce the land to a worse state than it was in before.

Land should never be ploughed in a wet state, for this not only gives encouragement to the growth of weeds, but also gives sourness and adhesiveness to the ground. Some soils will admit of being much wrought or pulverized by the plough, &c., in eradicating the weeds, and preparing them for the seed; while on others this would have the effect of nearly producing sterility, at least for one season. The intelligent farmer will adopt that mode of tillage which is best adapted to the peculiar nature of the soil he has to do with.

CROPPING.

The course of cropping is regulated by various circumstances. The kind and quality of the soil, and its peculiar properties; the seasons, the

most profitable application of manure; and the fact that no white or corn crop should be repeated in too rapid succession, are circumstances that always govern the prudent farmer in the adoption of a system. But the value of every rotation depends chiefly, if not entirely, on the quantity of food that is produced, during the course, for sheep and cattle, but particularly for sheep; and on its consumption on the farm, either in the fold or the stall. "No food, no cattle; no cattle, no dung; no dung, no corn," is a maxim that ought to be fixed in every farmer's mind. Turnips, vetches, clover, and saintfoin are indispensable in every good course, as winter, spring, and summer food; and the greater the crops of these are, the greater and more productive will be those of corn. These crops, of which the turnip crop is the principal, may, therefore, be considered as the foundation of all good husbandry.

In every system it is absolutely necessary to attend to the equal distribution of labour throughout the year; so that the work, which the system requires to be performed in each month, may be easily accomplished by the means you are provided with. The different operations should never be allowed to encroach on each other. If these are properly adjusted, the business of each week will be confined to the time in which it is required to be performed: regularity and economy in labour will be the consequences, followed by reciprocal improvement of soil and stock.

DESCRIPTION OF THE FARM.

We have selected the farm of Beverston, not only because there are most of the varieties of soil on it that are to be found on the whole range of the oolitic formation; but because we think that the mode adopted in the cultivation of this farm is well calculated for any farm on this formation; and because the diligence and economy which is practised in every department of the management are well worthy of the attention of every farmer in the kingdom.

Beverston Farm, consisting of upwards of 1300 acres, is situated two miles west of Tethury, Gloucestershire, on the Cotswold hills. The general aspect of the farm inclines to the south-east. It is all inclosed, and the fences, which consist principally of stone walls, are always in good order. The buildings, too, are kept in the best state of repair. A degree of neatness reigns over the whole farm; and, in every department of the establishment, order and regularity are maintained.

The system of farming, adopted by Mr. Jacob Hayward, the farmer, has grown out of the experience and observation of past years. It is not the offspring of fanciful theory; but of actual, continued, and successfu practice for many years; and the result has been to the advantage both of tenant and landlord.

The following are the sorts of soil on this farm:—

1st. A thin wet clay, of a most adhesive nature, covering the thin fissile till-stone. Of this sort there are about 220 acres, the greater part of which is very worthless. The whole used to be under the plough; but has been laid down to grass—the greater part since 1820. It has proved so unsound for sheep, and so apt to rot them at certain seasons of the year, that they are seldom, if ever, permitted to enter upon it. It is, on this account, of little value, and is pastured by young beasts.

2d. A light stony soil, above the oolitic rock. In some places this soil is about four inches from the calcareous rubble; in others it is not more than two or three; but so irregular is its depth, and so variable its quality, that, in a field of twenty acres, three or four acres of the same kind and quality are not to be found together. When the soil is deep, it is frequently

of a dead or 'fainty' sandy nature, of very little value. The best sort of this stony soil, is that in which the stones that are turned up with the plough are of a darkish colour; when they are whitish, the quality is very little worth.

3d. A soil, that has a good deal of clay in its composition, and of some depth, being neither too strong for turnips, nor too light and thin for beans. Of this, 57 acres are of natural grass, over which water can be partially thrown during the time of floods, and which are generally mown: 130 acres more are occasionally mown, and when not, they are pastured by cows and other stock. The remaining 40 acres, of this sort, are arable.

Of the whole farm about 400 acres are in pasture.

The farm-buildings are very inconveniently situated, the greater part of them, including the dwelling-house, being at the north side of the farm. There is a barn and a court near the south, and another barn and a court near the west side. But, from the extent of the farm, the greater part of the land is at a great distance from the buildings; so that, in carting either dung from the courts to the field, or corn from the field to the rick-yard, the average distance is about three-quarters of a mile. The whole of the wheat is always carted to the barn-yard nearest the house.

Tethury is a market-town of some note; but very little dung can be got from it. One year, however, upwards of 300 cart-loads were conveyed from it to this farm; but the expense of carting it, and of collecting it in the town, together with the price paid for it, amounted to a sum, which the increase of produce from it did not cover; and after two or three years of trial the plan was given up. The only manure, therefore, which is used upon this farm, is what is made by the stock kept, by the cleanings of the ditches and road-sides mixed together, and by the feeding off of all the turnips on the ground by sheep. This last is found to be the most valuable manure for this sort of soil. Lime has been tried upon this land, but with little or no effect, owing, perhaps, to the soils' being composed, principally, of calcareous matter.

ROTATION OF CROPS.

The greatest part of the arable land of this farm is cultivated according to the system generally adopted by the best farmers on the range of the Cotswold hills:—The first year, turnips; the second year, barley, or oats, if the land is not so well calculated for barley; the third year, clover, which is mown for hay, and is a mixture of red and white clover, trefoil, and rye-grass; the fourth year, clover, pastured with sheep, till July, when it is ploughed for wheat; the fifth year, wheat; the sixth year, barley or oats, if the land is better adapted for them; after this last crop, some of the best and cleanest of the land, being sown for winter vetches, is fed off in the spring with sheep, and then sown for the last of the crop of turnips—all the remainder forming the principal turnip crop; and thus the course begins again.

The last crop of this course, it may be supposed, ought not to have been taken; but having had clover for two successive years before the crop of wheat, the farmer not only thinks himself entitled to a crop of corn after the wheat, but believes he gets better crops by this rotation, upon such poor thin land, than he could get by having the crop of wheat after the first year's clover, or by putting a green crop, of any description, between the wheat and the oats or barley. Sometimes, however, the crop of wheat is taken after one year's clover; and if the land is firm enough for wheat,

it succeeds very well: indeed, wa have seen it succeed much better than after tbe second year's clover, upon land given to land-grass.

This plan is not generally adnpted in the neighbourhood, and when it is adopted, it is on land of better quality than the greater part of the farm of Beverston; but even when wheat is sown after one crop of clover, the farmer never fails to take a crop of barley or oats after the wheat;—a moda which would not be an improvement in a general system.

Some of the poorest land in the farm of Beverston is allowed to lie three years in pasture, before it is broken up for wheat. On the forty arable acres of the third and best sort of land in this farm, another rotation is adopted:—The first year, wheat; the second, beans; the third, barley; the fourth, Swedisb turnips; and the fifth, potatoes. The Swedish turnips, of tbe fourth year, are used the last in the season; and as it frequently happens that the land is too hard and dry to be ploughed up, and reduced in time for barley, potatoes, being an excellent preparation for wheat, have been introduced as the fifth crop in the course.

A seventh part of the arable land of the farm is always in saintfoin, wbich, when it is worn out, is broken up, and an equal quantity laid down in its stead.

I. *Turnips.*—We will begin with turnips, as being the foundation of all good farming on the Cotswold hills. If we succeed in getting a gnod crop of tbem, we may calculate on all the other crops of the course being good also. Nothing pnts land in better order tban a large crop of turnips; and on this crop depend entirely our prospects of future profit. We are, therefore, very anxious to prepare for this crop, get all the dung for it we can, and spare no expense in cleansing, hoeing, and *doing it well.*

With this root we can now cultivate with advantage those thin, light, dry soils, which, before its introduction, lay in a state of nature. The food wbich it produces for sheep enables the farmer to keep a much greater number of them; and the additional quantity of manure which is thus produced on a farm, where such an article cannot be purchased, is incalculable. The sheep are now kept on turnips during the winter and spring months, as well as, if not better than they are in the summer; and are fattened through that period of the year in which it used to be difficult to keep them alive.

The additional quantity of stock which the turnip system enables the farmer to keep is great. It is of the greatest value, therefore, in every course of husbandry, producing abundance of food for beasts, in the course of the production of abundance of food for man; and the soil being turned, by means of it, to the uses for which it is best adapted.

The whole of the arabla land on tha farm of Beverston is sown to turnips once in the course or rotation; about one-third of the whole crop consists of Swedish turnips, (the best of the land being selected for them,) the remainder of tbe white Norfolk and the red-tops.

Preparation for Turnips.—The land intended for turnips gets the first furrow, as soon as it can be accomplished, after the harvest is over. The first furrow is always ploughed as deep as the plough can go on this sort of land; and, it must be remembered, the soil on this formation is very shallow: for, in very few instances, and these of very limited extent, is it six inches deep, the generality of it being not more than four inches; so that if it can be ploughed four inches, it is thougbt a gnod depth. Before the first ploughing is given, all the spots on whicb there is any landgrass or black couch, are first hreast-ploughed. The reason for breast-ploughing these is, that the roots of the black couch not going deep into the ground,

but spreading over the surface and striking at every joint of the plant, the portion shaved off by the breast-plough containing both root and branch of the weed, it is much more easily dragged out after the second ploughing, and shaken out the first fine weather thereafter in spring.

The second ploughing is given to the land intended for turnips as early in the spring as the weather will allow, and across the ridges, as deep as the first. In January or February, it is generally completed; and, as soon as the land is dry enough, it is gone over ('twice in a place' where the land is foul) with the drag-harrows, and afterwards with the common harrows, to shake out the black couch, which is raked up and burned. The land is thus made as fine as is necessary for the crop; and all these operations are completed as early in the spring as possible. If the land requires another ploughing before the seed-furrow, no time is to be lost in accomplishing it. It is given for Swedish turnips in April, and in May for the common, that the land may lie some time before it gets the seed-furrow. The greater part of the common, and the whole of the Swedes, are drilled.

The middle of May is the best time for sowing Swedish turnips. In this climate they run to seed if sown sooner; and, if sown later than the end of this month, they do not do so well. The operation is performed in the following manner:—Some of the teams are employed in forming one-bout ridges, others are hauling dung and depositing it in the hollows between these one-bout ridges, at the rate of fifteen cart-loads per acre. The greatest care is taken to spread the dung regularly over all the hollows between the ridges, so that there may be a continued line of it from one end of the ridge to the other. When this is accomplished, some of the other teams follow, split the ridges with a double-mould-board plough, and cover the dung by turning them over. Then follows the drilling in of the seed, which is performed thus:—A light roller, which is made to roll two of these ridges at once, the first time it goes along the field, takes but one ridge with one of its ends; and, in returning, while it rolls this a second time with the same end, rolls a second ridge the first time with the other; which, again, in returning, it rolls a second time, along with a third ridge the first time. In this manner it goes over all the ground twice, the sowing-machine, between the first and second rollings, depositing the seed in the middle of the ridges, in a continued line, directly above the line of dung, and at the rate of three-quarters of a pound of seed per acre. This machine is guided by a man, and being attached to the roller, the same horse draws both: the machine is of Mr. Hayward's construction.

The time of sowing the common turnips is in June, and a great part of these is also drilled: but what is sown broad-cast is dunged before it gets the last ploughing, care being taken to have it spread equally over all the ground. The seed is sown with a machine, which a man wheels before him, and which sows at the rate of one pound and a half per acre and seven or eight acres a-day.

Hoeing.—The hoeing begins as soon as the rough leaf makes its appearance, on those that are sown broad-cast; but those that are drilled sometimes get the first hoeing before this period, particularly if the land is subject to annual weeds. Twenty men and boys are generally employed in this work. The turnips always get two hoeings, which cost fourteen shillings per acre, besides two quarts of beer per acre, for each hoeing. This work requires to be well performed, as on it depend, in a great measure, the bulk and value of the crop. The loosening of the soil about the roots of the plants with the hoe tends much to their growth.

Many farmers in this district put their lambs amongst the turnips in

August and September, to keep down the weeds that spring up amongst them, particularly the charlock. This does no good; and the presence of weeds is an evidence of the slovenly way in which the land has been prepared for the turnips, and of the imperfect manner in which the hoeing operation has been performed. *This* mode of weeding turnips by lambs is never resorted to upon this farm. The hoeing, as it is here performed, answers the purposes of thinning the turnips to the proper distances, of cutting up *all* the weeds, and of loosening the soil around the roots of the young plants, which both hastens and enlarges their growth.

The turnips, in general, are much larger, and the weight per acre much greater, when they are drilled, than when they are sown broad-cast; and the chief reason seems to be, that, when they are drilled, the seed being deposited directly above the dung, the roots of the plants get in contact with the whole of it; whereas, it is merely by chance if the seed is deposited upon it, when sown broad-cast.

The Swedish turnips require a better soil than the common; but the advantages of them are very great. Neither cattle nor sheep require so much hay by one-half, when feeding on them, as they require when feeding on the common turnips. And, besides this, they keep much better in the spring, which is of immense consequence,—the common turnips not keeping longer than March. In consuming the common turnips with sheep, one ton of hay per acre is generally given: only half this quantity is required by the sheep, when they have Swedish. The value of these, therefore, over other turnips, of the same weight of crop, is at least equal to half a ton of hay per acre. But the sheep also thrive much better upon them; and this is an additional value that cannot be estimated.

All the turnip crop is fed off on the ground; and, in folding, the plan adopted on this farm is to have three of four lots of sheep in the same field at once, but so as to allow each lot to run over the ground which it has cleared. It is found that, when sheep have a good quantity of ground to run back upon, they thrive better than when they are cooped up on a small space. By this plan, also, the dung may be distributed over those parts of the field in which it is most wanted, by putting each of the lots of sheep on the poorest part of the field first, and making them eat the turnips on the richest part last. The labour of a team that is required in cultivating this crop, may be stated equal to six and a half days per acre on what is sown broad-cast, and seven and three-quarters per acre on what is drilled.

A portion of the Swedish turnips is left for the sheep, till late in the spring. The land upon which they grow is much impoverished by the fresh growth of the plants in the spring. A peculiar course of cropping is, as we have already mentioned, adopted on this land, which is a portion of the best of the farm,—it is planted with potatoes, instead of barley.

II. *Barley.*—In preparing the land for the barley that is sown after turnips, it is either ploughed, or sometimes only half-ploughed, (*raftered*, as it is called here,) as fast as the ground is cleared, and, generally, across the field: the harrows are drawn over it, if it has been raftered or half-ploughed, to level the land a little, before it receives the seed-furrow. The first furrow is as shallow as it can be ploughed—just deep enough to cover the manure that has been dropped by the sheep; the second furrow is a little deeper. The land having been previously cleaned and well pulverized for the turnip crop, nothing more is wanted now than to get a good seed-bed for the barley and the seeds that are to be sown with it.

The labour that is required to prepare the land for this crop depends upon the state of the weather during the time the sheep were consuming

the previous crop. If the weather was dry, the land will be left in a most excellent, friable state; and with one ploughing, it will, perhaps, be in a better condition for receiving the seed, than with three ploughings, if the crop was eaten off by sheep in wet weather: for, by their trampling in wet weather, the surface of the land is left like clay well tempered for making bricks; and, unless the land, in this state, gets frost after the first ploughing, it will, in the second ploughing, be turned up in hard lumps, which cannot be reduced but with considerable labour. A heavy roller is used for this purpose; but no labour can reduce land, in this state, so well as a good, hard frost would in one night. The earlier that land, which has been trampled by sheep in wet weather, is ploughed, the greater is the chance of getting frost to assist in reducing it to a proper state of pulverization, a greater degree of which is required for the seed-bed of barley than for that of any other grain that the farmer cultivates.

The quantity of seed sown is four bushels and a half per acre; it is always sown broad-cast, and is never drilled on this farm, nor in the district.

Amongst the barley the grass seeds are sown with a machine, which a man wheels before him; and the plan adopted on this farm, and which is thought to succeed the best, is as follows:—The rye-grass, the trefoil and the white clover seeds are, with the barley, dragged in with the drag-harrows, with four horses, which go over about seven acres a day. After this the land is harrowed across with three horses at the rate of about ten acres a day. The red clover is sown with the machine, just when the barley comes above the ground, and is rolled in with a roller, ten feet long, drawn by two or three horses, which do about twelve acres a day. The reason for this part of the plan is, that the red clover frequently grows so fast, as to overtop the barley altogether. By this plan the barley gets the start of the clover, which is thereby kept in its proper place.

The quantity of grass-seeds required varies, according to the quality of the soil; but the average on this farm is,—two bushels of rye grass; six pounds of trefoil; four pounds of white, and eight pounds of red clover;—the proportions varying according to circumstances.

The produce is about three-quarters and a half of barley per acre. The expense of mowing is eighteen pence per acre, and one gallon of beer: the expense of thrashing, which is done with the flail, is two shillings per quarter, including the winnowing. About half of the straw is eaten by cows and oxen; the other half is trampled into manure.

III. *Clover after Barley.*—The grass seed sown amongst the barley consists of rye-grass, trefoil, and white and red clover seeds. The soil of this farm is not well adapted to red clover, which often fails; and, although upon some of the land the plants come up and seem to thrive, yet the crop is always very light, the rye-grass forming the principal part, if not nearly the whole of it.

The whole of this crop is mown and made into hay. The mowing commences, as soon as the sainfoin hay is cut down, and just when the blossoms of the rye-grass and red clover appear. This is about the first or second week of June—never later.

Hay of the above composition of grasses Mr. Hayward thinks the best of all hay, if it is cut early, when the natural sap is flowing; for a process of deterioration commences and goes on from the time the rye-grass begins to come into blossom till the seed is perfected, the plants becoming hard and the natural sap being dried up, in which state it is of little or no value as hay, and little better than wheat straw. When rye-grass and clover are allowed to perfect their seed, they are thrown into the cribs of the store-stock, or cut up with other hay as chaff for the working cattle.

The whole of the clover and rye-grass on this farm is cut down, whatever is the state of the weather, as soon as it is ready; for it takes more injury by standing than by being cut down in a wet state. A man generally mows an acre and a half a day. There are generally twenty mowers employed upon this farm; and from thirty to forty haymakers, the latter consisting of men, women, and stout boys. The mowing costs sixteen pence an acre, and a gallon of beer a day to the mower.

After the grass has been cut down about two days in drying weather, and has become withered or dried on the top of the swath, it is turned over with a rake, in doing which care is taken to keep it together as much as possible. It sometimes requires to be turned a second time; but only when the weather is unfavourable. As soon as it is dry enough, it is put into cocks with the barley or three-pronged forks, and raked between the cocks with the long or ell-rakes. These rakes, which are more than double the length of the common rakes, are used in preference to the latter, because more work can be done with them. The waggons, following after those that are cocking, clear the field as they proceed. The strength of team that can be brought to bear upon a single field soon carries the whole of the hay to the rick. The ricks are built on or near the place where the hay is intended to be consumed; and in the field sown to turnips, a rick, equal to a ton per acre, is generally placed.

The whole of this crop is consumed by sheep and horses. Great crops of clover and rye-grass hay are not to be expected upon land of the quality of this farm. A ton per acre is reckoned a great crop.

The second year's crop of clover and rye-grass is fed off with sheep. Every means is used to prevent the rye grass from coming to seed; for if seed is produced, it will grow amongst the wheat, the following year, injure it very much, and shorten the crop. The couples (an ewe and lamb) are put upon this crop in the first instance; and after the lambs are weaned, the whole of the ewes. They are kept so very thick upon it as to crop it to the very ground; for the harder the ewes are kept, when their lambs have been newly taken from them, the sooner the milk goes from them. This crop keeps two couples per acre for about six weeks; and four ewes, after this, till it is ploughed up for wheat.

IV. *Wheat.*—The wheat crop, as we have already observed, is generally taken after the second year's crop of grass, which has been pastured by sheep, and eaten by them so close to the ground, that none of the rye-grass may come to seed. The preparation of the land for wheat begins immediately after the turnips are sown. This is about the first of July. The land which requires it, is first raftered or half-ploughed, that it may lie in this state for some time to let the turf rot. It is then harrowed and gets the seed-furrow in August. But all the land, that requires only one ploughing, receives the seed-furrow before that which has been raftered; for when it gets only one furrow, it requires to lie longer before it is sown.

The sowing begins, without any other preparation, as early in September as the season will allow, that is to say, as soon as the land is wet enough for it. The heavy drags, with six oxen or four horses, go over the land "twice in a place," in the same directions in which it was ploughed, taking care that the crowns of the ridges and the furrows get a full share of this operation: indeed, three times of the heavy drags is generally given them to break the staple of these parts of the ridge. The drag-harrows follow after the heavy drags, and go over the land obliquely "twice in a place" also. The last part of the process is performed with the common harrow, at right angles to the way in which the land was ploughed. The reason for altering the direction in these several operations, is, that the upper part

of the furrow-slice may be well broken without turning it over; and because the tines of the drags and harrows get deeper into the ground in this way, and are much more efficacious than if the whole of these operations were performed in one or two directions. The rougher the surface is left after this the better, if the clods are not too large. Women are now employed to go over the whole of the land that is sown, to break all the large clods and to turn all those that have any grass on them with the grassy soil undermost. Whatever part of the wheat requires it is hoed, as early in the spring as possible, by men with narrow hoes, at from three and sixpence to five shillings per acre.

The seed is selected of the best quality, of the *previous year's growth*, and perfectly clean and free from all seeds. The red-straw-lammas is the kind that is always sown upon this farm. No such thing as smut is ever known upon this farm, which is prevented, we believe, by the invariable use of old wheat for seed. When wheat that has been harvested in August is sown again on the first of September, it has not had time to be so well hardened and so perfectly prepared for vegetation as it ought to be; and, therefore, does not produce a crop so perfect, in every respect, as old seed: and hence the smut. Nor is there often either rust or blight on the wheat produced on this farm, which is probably owing to its being much exposed.

The wheat harvest, in the Cotswold hills, begins generally in July; and Mr. Hayward is fully persuaded of the propriety of harvesting this crop, before it is fully ripe, the quality of the grain falling off very much, when it is allowed to stand till that time. The proper time for cutting it is, he thinks, when the roots cease to convey nourishment to the plants. The expense of reaping is six shillings and ten quarts of beer per acre.

The whole crop is carried, as soon as it is ready, and stacked in the barn-yard adjoining the farm-house. When this operation begins, the whole strength is brought to bear upon one point. We have seen a large field, at the distance of a mile and a half from the barn-yard, cleared in a day by seven teams and eight waggons, conveying from the field to the ricks forty-two waggon loads of about thirty bushels each. This was six journeys of three miles to each of the teams, besides the distance gone over in the field in loading the waggons, which would make the whole journey for each team at least twenty miles. The ricks are made very large; consequently a great many hands are employed. Two ricks are building at the same time, and one of them is always nearer finished than the other. While the rick is level with, or lower than the waggon, only one man is employed in unloading; but when the rick is higher than the waggon, there are two employed till the rick gets very high, when one man unloads, the work being then necessarily carried on more slowly. When there are two men unloading the waggon, there are generally three building around upon the rick, attended by three boys or girls to lay the sheaves to them, and other two to throw the sheaves to the former from the pitchers. On the other rick there are one or two builders, with a sufficiency of tenders to carry on the work with expedition and efficiency. In the field there are two men pitching to each waggon, two building the waggon, and a boy driving the team. There are always two waggons by the rick unloading; two in the field, loading; two on the road, with loads from the field to the rick-yard; and two empty ones going from the rick-yard to the field. After the wheat is carried, the stubble is mowed and carried to the yard, stacked and used as litter for the beasts in the courts.

The expense of preparing the land for a crop of wheat may be estimated at two and a quarter days' work of a team per acre; but it is im-

possible to make an *exact* estimate of the labour required for this or any other crop, the labour itself varying with circumstances. The state of the weather alters the state of the land. If the weather is adverse, the labour is increased; if favourable, it is diminished.

When, as is sometimes the case, a portion of the poorest of the land is allowed to remain three years in grass, an equivalent portion of what has been but one year in this crop is prepared and sown with wheat; in order to preserve, as nearly as possible, the regular quantity of wheat and of clover for the food of the sheep, which is about one-seventh of all the arable land.

The thrashing of the wheat is performed with a machine and four horses, by four men, three women, and a boy, thrashing from ten to twelve quarters a day, and costs about a shilling a quarter for manual labour, making, if we take into account the value of the horses' labour, the expense of this operation with the machine, at least, equal to what it it would be if the work were done with the flail. The advantage of the machine is, that you get the work done at once, whenever you wish it, and without the loss of corn attending the use of the flail, which is, at least, equal to the value of the horses' labour in the season of the year when wheat is generally thrashed out.

That part of the wheat stubble which is foulest is breast-ploughed and burned in the spring, and sown with turnips. It afterwards takes its course in the general system.

V. *Oats and Barley after Wheat.*—The land generally gets two, sometimes three ploughings,—the first as early as possible, the second early in March. When the land is clean, it is raftered or half-ploughed only the first time. The oats are sown, about the end of March, upon the coarsest or roughest of the land. The seed, of which six bushels are sown to an acre, is dragged in with the drag-harrows, and is afterwards harrowed sufficiently with the common harrows to cover it. The sowing of barley should begin and end in April. In preparing the land for this crop, it requires from three to four days' work of a team per acre;—the oats requiring more than the barley, because they are sown upon the roughest part of the land.—The oats and barley are stacked in one of the rick-yards nearest the field, and are built into square ricks; but all the barns are first filled with barley. They are thrashed with the flail, at two shillings per quarter.

BEANS.

A very limited quantity of beans are sown, and these after the wheat-crop, upon that portion of the forty arable acres of the third or best kind of land, on which a peculiar rotation is adopted. The land receives only one ploughing. It is ploughed before Christmas, and the planting is begun as early in the spring as the weather will allow. The mode adopted in this neighbourhood is, to plant the beans in rows about fifteen inches apart, and about eight inches from hole to hole in the rows, dropping three or four beans into each hole. They are planted at this distance in the rows, that there may be room for the hoe to get in between them, when they are hoed. The Berkshire bean (as it is called here) is used for seed; and about three bushels are required to plant an acre. The planting, which costs about five shillings per acre, is performed by men and women; and the ground planted is run over each day with the harrow, tu fill up the holes and cover the beans. The hoeing (two hoeings being given, if required) begins as soon as the beans are above the ground. It requires to be done as deep as to reach the roots of all the weeds; and costs from six to eight shillings an acre.

Instead of being ploughed, the land is sometimes dug with the spade, which can be done when it is too wet to admit of being ploughed. The expense of digging is from twopence to twopence-halfpenny per perch, or from twenty-six shillings and eightpence to thirty-three shillings and fourpence per acre.

The reaping of this crop is never done till all the leaves drop off, and the stalks begin to get black. It is reaped, tied into sheaves, and set up into shocks for eight shillings an acre. It is soon ready to be carried after it is cut, and it is stacked in the rick-yard. It is always thrashed out with the flail, and at the rate of twenty pence per quarter. The produce is about twenty-four bushels per acre. The straw is kept to put under the ricks, and is afterwards made into dung. After the crop is carried, the land is dragged first one way and then across, to loosen the roots. These form a good store of winter fuel for the poor, who are allowed to pick them up, and for whom Mr. Hayward carts them home.

POTATOES.

Upon the forty arable acres of the best sort of land, potatoes are introduced in the rotation after Swedish turnips, which are fed off so late in the spring, that it would be difficult to get the land prepared for barley or oats. The only thing peculiar in Mr. Hayward's mode of cultivating this crop is, that he generally plants them after the breast-plough instead of the common plough; and as it is intended to describe the mode of cultivating this most valuable root, practised on the farm of Stancombe, in the lower part of this county, where the cultivation of it is the principal object of the farmer's attention, we shall abstain from any details here.

VETCHES.

A crop of winter vetches is taken upon a portion of about thirty acres of the best and cleanest of the land, destined, in the course, for turnips. The land is ploughed once, as early as possible after the crop of oats or barley is cleared. The vetches are sown broad-cast, and dragged and harrowed well, to get all the seed covered, two bushels and a half of which are required per acre. A few acres of them are generally kept to supply seed for the crop of the following year; and a small quantity sometimes cut and given as green food to the horses in the early part of the spring. All the rest is consumed with sheep on the ground,—the sheep being folded on them as on turnips. As the vetches are fed off with the sheep in May and June, the land is prepared for turnips; and the cultivation necessary for these after vetches is the same as that which has already been described.

Vetches, like every other crop, thrive best upon the freshest land, that is, upon the land which has not grown a crop of the same kind for the greatest number of years.

SAINTFOIN.

This plant will not grow upon the thin clay, nor upon the dead or 'fainty' sand: but upon all the stone-brash soil, it is the most valuable plant that ever was introduced into this district; for with it the farmer is able to get one ton and a half of the most excellent hay, where he could not get one-fourth of that quantity before. The dryest season seems not to injure it, nor does a wet season retard its growth. It makes the best food for sheep and horses; and the hay made from it will keep three or four years without sustaining the least injury.

The saintfoin crop is taken, on this farm, after the barley, which follows

the turnip crop in the general course. But as the sheep, which consume the turnips on the ground, consume also upon it one ton of hay per acre, the seeds which drop from the hay would grow up amongst the saintfoin, were it sown amongst the barley. Mr. Hayward, therefore, prefers taking a crop of oats after the barley, that all the seeds of grass, lop-grass, and other seeds, which come up amongst the barley, may be destroyed by the two ploughings that are necessary in preparing for the crop of oats. The saintfoin is sown amongst the oats, at the rate of four bushels per acre, without the mixture of any other seed whatever, the saintfoin being thus left in full possession of the ground. The first year's crop of saintfoin, which is had by thus sowing it unmixed with trefoil and other seeds, contrary to the practice of some farmers, is light; but the plants are much stronger the second year, and it then comes to a full crop. Some farmers sow only from two and a half to three bushels of seed per acre; and although, when sown so thin, the plants may last longer, yet their stalks are much larger and more woody, and make strong, coarse hay: whereas, when the land is sown thick, the stalks being much closer together, are much finer, and the hay is of a very superior quality. In the latter case also, the sheep eat the saintfoin much better, when they are put to pasture it, after the crop of hay is made.

When the saintfoin plants begin to fail, which is about the sixth year, the land is pared, and burned, and sown to turnips, being first properly prepared, and then enters into the general system. But it is never broken up till another portion of land has been laid down to fill its place, one-seventh part of all the arable land being always in saintfoin.

The saintfoin is earlier ready for the scythe than the clover; and as soon as the blossoms appear, it is cut down. The sooner it is cut, after their appearance, the better is the quality of the hay, though the quantity may not be so great. If it is allowed to stand till all the blossoms come out, the stems get very woody and hard, and it loses great part of its excellent qualities as hay. This plant, like clover, must not be shaken about much in making it into hay, as the leaves easily part from the stalks. It is on this account turned over only once; and if the weather is at all favourable, as it lies very loose and open, it will be ready to carry in four or five days, with one turning.

The time of mowing the saintfoin crop is about the first of June. The expense of mowing is generally two shillings per acre, and a gallon of beer to each man, per day. It is a good day's work to mow one acre and a quarter of this crop, which produces one ton and a half per acre of hay, of the most excellent description for fodder for sheep and horses.

The latter-grass is fed off with lambs in August and September, and generally keeps three lambs for two months. The crop of the sixth or last year is always pastured with sheep, being very seldom worth mowing.

When part of this crop is allowed to stand, to afford the seed required in the following spring, it is always carried and stacked, either early in the morning, before breakfast, or late in the evening, the seed being easily shed, if it is turned or mowed, when the sun is strong upon it. Twenty bushels an acre is reckoned a good crop.

ENGLISH, OR MEADOW HAY.

The meadow or natural grass is the last that is mown; and the hay-making machine is put to work in the field to ted or shake out every day's work, the day after it is cut down. This it does in the most perfect manner, and the whole of the tedding is done with it, till the grass begins

to get dry, when, as from the violence of its operation it would shake out the seed, its assistance is dispensed with. In wet weather it is very useful ia shaking out the hay that has got stained or hss clung together from the rain.

Wben the hay-making machine has done its work, the hay is hatched or rollered up, as it is called; that is, two people with rakes, and working in contrary directions, rake up the hay into continued rows from one end of the field to another. When the field is all hatched or rollered, people witb forks make up the hatches into cocks, of such a size as the dryness of the hay will admit of. This is done the last thing in tbe evening; and next morning these cocks are again shaken out, (three or four of the rows of cocks together,) but much thicker than before, nnd turned over two or three times during the day with picks or prongs. In the evening the hay is rolled together, and then put into larger cocks; after which, if the weatber is fine, it will be ready to carry. It is carried in waggons to the rick-yard, and built into square ricks.

It is a great advantage to hay to get a little heat in the rick. If in making it all the natural sap is dried out of it, it is neither of so good quality as that which has been heated by part of the natural sap being permitted to remain, nor does it get so close together, and keep so well.

The natural heat, being a slight fermentation, improves the flavour of the hay, and producing, probably, a portion of saccharine matter, thereby adds very much to its value. Much heat, however, injures the hay, and sometimes sets it on fire. The whole of the meadow hay on this farm is consumed by the dairy cows. Salt has never been tried amongst hay on this farm.

STOCK.

Sheep.—A flock of about four hundred and forty breeding ewes is kept upon this farm. They are of the mixed Cotswold and Leicester breed. The ewes will feed to about twenty-four pounds per quarter; but none of the sheep are fattened on the farm. About four hundred are sold yearly. About two hundred of the oldest and worst of the ewes, and a like quantity of wethers; and they are sold in autumn—in September or October, according to the state of the market. The loss from death is about five per cent., or one in a score, in the whole flock. In the year 1825, the loss in lambs was only six in four hundred and forty-eight, including all the casualties of the year. This was the best year for sheep on this farm ever known. But in 1828 the loss was very great, amounting to eighty-two lambs in four hundred and forty-two, besides old ewes, &c. This was the worst year for sheep ever known on this farm. They were carried off by what is here called the white scour, which began with a stoppage and ended in excessive laxativeness.

The sbeep not being disposed of till autumn, upwards of eight hundred are shorn every year. The fleeces may average about five pounds and a half each. The wool is long and fit for combing.

The folding of sheep is generally adopted on the whole of the Cotswold hills. The greater the number of sheep kept on the arable land, the greater is the produce in corn. Upon the best cultivated farms in this district about one sheep is kept to an acre of land. Upon this farm there are upwsrds of twelve hundred kept upon about one thousand acres.

The shepherd's house on this farm is placed between the arable and psture lands; and the garden attached to it, which is large, is enclosed with high stone walls. This garden is converted into a lambing-fold in the spring. It is made to consist of four general divisions, two of which,

occupying the space where the walls are highest and most sheltered, are for the ewes lambing in. The young ewes are placed in the one, and the older ones in the other. In these two compartments of the fold and along the walls, pens are formed of hurdles, of the length and breadth of one or of two hurdles, as circumstances require. These pens are intended for the reception of the ewes that have newly lambed, with their lambs.

In the formation of these pens, the economy which distinguishes the whole management of this farm displays itself. As a great number of stakes are required, to which to tie up the hurdles, not only in this fold, but also where the turnips are fed off, in building the walls of the garden temporarily employed as a fold, recesses, about six inches deep, of the height of a hurdle, and at the distance of the length of one from each other, have been formed in them. The ends of the hurdles being inserted into these recesses are fixed at the ends next the wall, without the aid of stakes. At the opposite ends, they are made fast to stakes in the usual way; and thus pens are formed around the wall.

Into these pens, as has been intimated, the ewes that have newly lambed are put with their lambs, a separate pen being allotted for each ewe and lamb. They remain in the pens till they are able to go in one of the outer and general divisions of the lambing-fold, which are for the admission of ewes and lambs, when the lambs are strong enough to take care of themselves. From these folds they are at liberty to go, in the day-time, into a pasture or fallow-field, and from the pasture or fallow-field into a Swedish turnip-field.

The lambing begins in the beginning of March, and is nearly over by the end of that month. When all are able to leave the lambing-fold, they are divided into three lots;—the oldest, being the six-teeth and full-mouthed ewes, with their lambs, into one lot; the two-shear, or four-teeth ewes, with their lambs, into another lot; and the young or two-teeth ewes, with their lambs, into a third lot. These lots are kept apart, each having a separate division of the pasture or fallow-ground to run in, and of the Swedish turnips to feed.

The ewes do not get any turnips till they drop their lambs. This is only because the quantity of turnips on this farm does not afford a supply for them; and although giving them as many as they could eat would prove injurious to them, yet about one-fourth of that quantity would do them a great deal of good. The sheep that are fed upon hay without turnips are allowed an unlimited supply of water; and they drink a great quantity in dry weather.

In October, the lambs, in three or four lots, are folded on the turnips, and have about one ton of clover hay to an acre of turnips. As it is not desirable that the lambs should clear up all the turnips, the shepherd puts them up in the most convenient part of the field, for about two hours every day; and, during this time, the young or two-teeth ewes that are fed on hay, in the adjoining field, are admitted into the fold to clear up "the hulls" or those bits of the turnips which have been left by the lambs. This does the sheep a great deal of good; for, although the quantity left for them is very small, yet, being moist food, it makes them eat their hay with a much better relish. They are frequently put to run in a fallow-field, if there is not a pasture or clover-field adjoining the turnip-field, on which the lambs are folded.

When the lambs are weaned, they are turned into the clover latter-math; and the ewes into the grass-field that is intended for wheat, where they are kept very hard.

The food, for the flock of sheep in the winter and the early part of the

spring, is turnips, clover, and saintfoin-hay; in the latter part of the spring and in summer, the second year's clover, vetches, and some of the dry pasture-field, the latter math of clover, and of saintfoin, the stubbles, the young clover, till October, and the last year's or worn out saintfoin.

It is reckoned that a hundred lambs will consume one acre of turnips, of twenty tons, and a ton of hay in fourteen days; and that a hundred sheep, having a large field to run in, and plenty of water, will consume one ton of hay in seven days.

CATTLE.

Upon this farm there is a dairy of forty cows, of a mixed breed, between the Wiltshire long-horns, which are famous for giving a great quantity of milk, and the Gloucester breed, which are good feeders as well as good milkers.

The cows are pastured upon the old grass-land, and from them are bred yearly twenty heifer-calves; and six ox-calves of the Hereford breed are bought in every year. The remainder of the calves are sold as soon after they are calved as a purchaser can be found for them. The six Hereford ox-calves that are bought are reared for the purpose of keeping up the number of working oxen, of which there are always eighteen upon this farm. The stock for working oxen is thirty-six, in all—six calves, six year-olds, six two-year-olds, six three-year-olds, six four-year-olds, and six five-year-olds; so that there are six oxen, coming six years old, for sale every year; and six young oxen, coming three years old, ready to take their place. The twenty heifer-calves are bred to keep up the stock of dairy-cows. This exceeds the number generally bred by the dairy-farmers; but it is required by the quantity, upon this farm, of poor, thin, wet pasture-land, unsound for sheep, which must be fed off with young beasts. The healthiness, too, of the stock, upon this farm, even upon the poor, thin clay land, unsound for sheep, is a great inducement to keep a large breeding-stock. The cattle are never affected by the husk, the quarter-evil, or the red-water.

The stock for dairy-cows is, in all, a hundred, and consists of twenty calves, twenty year-olds, twenty two-year-olds, and forty cows of all ages. In the autumn, ten of the oldest or worst of the cows are sold, and their place is filled up by ten of the best of the two-year-old heifers, which calve in April or May, when they are three years old. The other ten of the two-year-old heifers are sold sometimes in autumn; but they are generally kept till May, when they calve, as more money can be got for them then, there being in that month a great demand from the dairy farmers for milk heifers.

By the above plan a gradual improvement of the dairy-cows is going on, and the greatest care is taken in the selection of bulls; for on them, in a great measure, depends the improvement of the stock.

With such an extent of poor pasture land, and such a stock of straw upon this farm, it is not found advisable to fatten any of the stock for the butcher. Accordingly, the whole of the cows, oxen, and sheep for sale, are sold to the graziers, generally in the autumn, when they are in excellent store-condition.

The calves are foddered during the winter in the pasture-ground, where there is most shelter, and where there is a little pasture. They are foddered with hay in the field from about the middle of November, till they are turned out to the pasture in May. The year-olds are kept in the field all winter, in the same way as the calves, but get straw instead of hay, till near Christmas. They, of course, require more hay than the calves; but

much hay is saved by their eating up the rough grass, left by the cows that pastured the ground in the summer, the calves and the year-olds being kept, during winter, in the old pasture-lands, never upon the poor, wet, thin clay. In no instance are more than ten allowed to run together in one field; and they are sorted according to their strength, so that the master bullocks are prevented from running down the weak ones, and the best of the hay can be given to weak ones and to the calves. Mr. Hayward has found, by long experience, that young stock thrive much better, when, in winter, they run out in the field, than when they are kept in a house, or shed, or the straw-yard.

The two-year-old beasts are put up, in winter, by themselves, in a court at one of the remote barns, where they are at liberty, in the day-time, to run out in the field adjoining the court. They are assorted in the same way as the other young beasts, the number put into one court seldom exceeding ten. They are foddered with good straw till Christmas, after which they get hay. It being absolutely necessary that all beasts should have plenty of water, the several lots are at liberty to go to the pond whenever they are inclined.

The two-year-olds must be kept much better than the other young beasts in the latter part of the winter and in the spring; as their productive or their useful season is then drawing near,—the heifers calving in April or May, and the young steers coming into full work at the plough in the spring. All the spring, therefore, a good quantity of hay is served out to them.

The cows are fed, during nearly the first half of the winter, upon straw; and during the other half, upon meadow-hay. When the cows drop their calves in the spring, they are tied up for about two hours, morning and evening, for the convenience of milking. At these times hay is served out to them in the stalls, that the weak ones may feed undisturbed by the stronger ones; and, when they are turned out into the yard, although they have left hay in their stalls, they instantly go to the cribs in the yard, and eat the hay that is there with as good an appetite, as if they had received nothing during the two hours they were tied up. All the hay left by them in the stalls is taken out and put into the cribs in the yard, where they eat it with avidity, although they loathed it in their stalls. This is thought by Mr. Hayward to be an evidence, that beasts cannot do so well when tied up, as when they are allowed to run loose.

The cows are put out to pasture in May upon the best of the old pasture land, about seventy acres of which are required for them, till they can be put upon the after-math of the meadow-land that is mown. All the young stock depasture on the poor, thin land.

The working oxen get straw, and generally a few turnips, in the yard, during the first part of the winter, when they are not much worked; but when at work in the spring, they get hay. Good rye-grass and clover-hay is best for them, as it remains much longer with them than the meadow-hay, which runs through them too fast, when in hard work. When the supply of hay is short, straw and hay are cut into chaff for them. In summer they depasture on the unsound grass land. No corn is ever allowed them.

The quantity of hay consumed by the beasts during the year may be reckoned at about twenty-four tons for every ten of the cows and the working oxen; twenty tons for every ten of the two-year-olds; ten tons for every ten of the year-olds; and eight tons for every ten of the calves.

Horses.—The horses are fed, in winter, upon straw and a little hay, and about half a bushel of oats each per week; but in spring, when they are in full work, they get hay and a bushel of oats each, per week, besides

the chaff that has been collected from the winnowing of the wheat, barley, and oats, and kept for them, and which, if heated from a great quantity of it being kept together and pressed down, is the better for it.

When light corn or "tailing" is given to the horses, an additional quantity is allowed them to make up for its lightness; besides what compensation may chance to be made to them by the workmen, who are not very scrupulous about taking corn for their horses, as opportunity offers,—a species of dishonesty not to be too severely reprehended.

The horses get saintfoin-hay, and always some of it along with the chaff from the winnowing of the corn, which is unsound for horses when given them alone. Chaff, half composed of wheat-straw and half of saintfoin-hay, is cut for them, and given them for about six weeks in the winter, the chaff from the winnowing of wheat, barley, and oats during this time, being stored up for their use in the spring. While they are on this cut chaff, a few turnips are sometimes given them, which are of use in keeping their bowels open, when they are fed upon dry food.

In summer the horses depasture upon the unsound pasture-ground.

Upon this farm there are generally kept ten horses and two brood-mares; two working colts, two year-old colts, and two sucking colts, besides one riding-horse. Two colts are generally bred from the mares to keep up the stock of working-horses.

The quantity of water required by stock, in summer, is very great. No less than a thousand gallons a day were consumed by the stock on this farm,—eight hundred by the eight hundred sheep, and two hundred by the other stock;—the computation having been made by means of a pond, the dimensions and contents of which were known.

ESTABLISHMENT.

On this farm, although large, no bailiff is kept. Mr. Hayward attends to everything himself, directing every operation, and seeing that it is properly performed. Thus employed, he has not time, nor, finding it incompatible with his interests, has he any inclination to go a-hunting three or four days a week, as some farmers in this district still continue to do. He, therefore, saves the expense of a bailiff, as well as that of a groom and hunter, which this amusement would render necessary to him. The present distressed state of agriculturists will not admit of such expenses. Care must be taken to save at all hands, and to make the most of everything; and where, as on this farm, a great number of workmen are constantly employed, more is gained by economy in their time and labour than most people are aware of.

Upon this farm there are constantly employed, twenty-five men, seven boys, and three women, viz.,—four men as carters, one of whom being headsman has the charge of the rest, and sees that the horses are attended to; four stout young lads as plough-boys; three ox-men to work the oxen, with three boys to drive, one of these men also being a headsman, in whom a greater degree of trust is confided, and who has the superintending charge of the oxen; three cow-men, to attend to the dairy-cows, one of them having the principal charge of the cows; one shepherd; eight men who, in winter and spring thrash the corn, in summer and autumn mow the grass for hay, hoe the turnips, reap the wheat and beans, and mow the oats and barley,—and who are paid for their work *by the great*, or by piece-work, seldom or never by the day, receiving so much a quarter for thrashing, and so much per acre for mowing grass and corn, and reaping wheat and beans; six men and boys, paid also by the piece, seldom or never by the day, and employed in paring and burning

in the spring, in mowing grass for hay in summer, in turnip hoeing in the season, in mowing and reaping in the harvest, in mowing and raking stubble, and in breast-ploughing stubble in the end of harvest and winter; lastly, a house-keeper and three women employed in the dairy.

Besides the above number of hands, in constant employment throughout the year, there are employed, in winter, a man to assist the shepherd, and two boys to dock up turnips for the sheep; and in the months of March, April, and May, not less than fifteen men, women, and boys, to rake what has been pared for burning and to burn it, to hoe beans and wheat, weed corn, clear up the grass-land, pick up stones, &c.—An additional number of hands is always put on when required. During the hoeing of turnips this year in July, the whole number employed on this farm was sixty-seven. In harvest, such an addition is made to the hands as is sufficient to execute the work in proper time; and in reaping wheat, we have seen a hundred employed, besides those occupied in mowing oats and barley, and in the other operations of the field.

Most of these labourers receiving beer, a considerable quantity is consumed; but to reduce it, a good deal of piece-work is bargained for, without beer. But although this plan is adopted as much as possible, yet we find that, on the average of several years, a sum equal to 58*l.* 9*s.* 10*d.* a year has been paid for malt and hops, for beer for the labourers on this farm. The greatest sum for this purpose (92*l.* 8*s.* 6*d.*) was expended in the year 1826, when malt was 9*s.* 6*d.* per bushel.

IMPLEMENTS.

The plough used on this farm and in the neighbourhood is the Beverston plough, invented by Mr. Tugwell. Wooden mould-boards are much in use, particularly where the soil is adhesive, as it does not stick so much to wood as to iron. The plough is short, with one wheel, and made of wood. It is worked with three horses, or four oxen, although *one* horse ploughed, in four hours and thirty-five minutes, one acre of two-year-old clover, before the Committee of the Bath Society, in this neighbourhood, in 1808. Iron ploughs have been introduced in this district; but the first cost and the difficulty of repairing them prevent their general adoption. Lord Somerville's double ploughs are used for ploughing the turnip-land a second time in spring: they are drawn by six oxen or four horses; and, where the work is light, they are of great advantage, as they get over the work twice as fast as the common plough. Both horses and oxen, when at work in the plough, are yoked before each other and walk in the furrow. The oxen do most of the ploughing; the horses, the harrowing, carting dung to the field, and corn to the market.

THRASHING.

The wheat only is thrashed with a machine, which does at the rate of ten or twelve quarters a day. It is driven by four horses, and four men, three women, and a boy are required to attend it; so that as many hands are employed as would be required to perform the operation with the flail; and the expense is, at least, as great. The only advantage of the machine is, that the work can be done in a much shorter time, and that a saving is effected in the quantity of the grain. The oats, barley, and beans are always thrashed out with the flail.

MANURE.

The improvement of the soil which he occupies ought to be the object of every farmer. Land, in a natural state, if dry, undergoes a gradual

improvement from the yearly growth and decay of the vegetable substances which grow upon it. But if the vegetable substances that grow upon it are eaten off by sheep, which drop their dung in return and in small portions at a place, the improvement goes on much more rapidly. Hence land, that is always pastured by sheep, is always improving, while that which is always mown is deteriorating. The number of sheep, therefore, kept on this farm, tend much to its gradual improvement; and the regular deposition of the sheep's dung over so great a portion of the farm, every year, in consuming the turnip crop, is an excellent preparation for the course of cropping that is to follow. The double manuring which the land thus gets, in the same year, may be thought by some to be too much; but the land of this farm and of the whole district is so thin and brashy, that it can hardly be overdone with manure.

Nearly all the manure that is made on this farm being applied to the land that is prepared for turnips, is generally carried out into the field, which comes in course for the crop, in the end of autumn or in winter; it is laid upon road-scrapings and other earth, that has been previously conveyed to the place, and is well mixed with them by turning the whole over with the spade. This is generally done twice, to get the whole well mixed and rotted, it being found by experience, that well rotted dung is the best manure for turnips on this land. The dung from cow, ox, and young beast-courts, from the stable-yard, and what is made in the sheep-lambing fold, are all carried to the field, intended for turnips, and prepared as above described. Besides this and that which is dropped by the sheep, when folded upon turnips and vetches, the ashes produced from the paring and burning of the old saintfoin, when it is broken up, and from the stubble that is overrun with black cootch, when it is pared and burned, act as a manure, and are an excellent preparation for turnips. If the ashes are abundant, they produce a crop of these, equal if not superior to what would be produced by fifteen loads of good rotten dung.

PROPER SIZE OF A FARM.

Of late years large farms have been cried down, as depriving the labouring class of employment; and much has been said on this head, without, as it appears to us, due examination into the subject. If we look at the number of hands that are constantly employed on this farm, and compare it with the number employed on a number of small farms, which together would make thirteen hundred acres of land of such kind and quality as this is, we have no doubt but that the number on Beverston farm would be found much the greater. The large farmer has capital sufficient for all the expense required to cultivate his land properly, and in a proper time; but this is not always the case with small farmers.

Small farms are generally let at a greater proportionate rent, it is said; if this is the case, the landlord, on the other hand, is put to a greater expense in erecting buildings, &c., and the rents are generally worse paid than those of large farms. Mr. Hayward's opinion with regard to the size of a farm is, that "it cannot be too large, if it be *well done to;* nor too small, if not *well done to.*"

TITHES.

The tenants of this parish have a lease of the tithes for fourteen years, at a corn-rent, the yearly average price of corn determining the sum which the tenant has to pay for his tithes. This is an excellent arrangement, and if the tithe-question were settled in this or some similar way, a great agricultural improvement would follow, sufficient perhaps to give to Eng-

land a supply of corn sufficient for her population, and enabling her to export what she at present imports. The tithes of arable land might be valued at so much wheat, barley, oats, or beans, according as the land might be fit for the production of such crops; and the grassland, at so much cheese, or beef, and mutton, according as it might be fit for a dairy or for fattening sheep or oxen; and the sum to be paid to the clergyman settled every year, according to the average price of the several articles.

No circumstance retards the improvement of land more than the present mode of exacting tithes. Nothing can be more galling to an industrious man, than that, when he has laid out a large sum on the improvement of his farm, and it is beginning to yield him an increased return, the tithe-man should come and take the tenth of the fruits of his industry, capital and talent. "The tenth of the natural produce," say many, "belongs to the church;" but surely it never was intended, and certainly it never was justice, that the church should take the tenth of that which is produced by artificial and expensive cultivation, without also bearing a tenth part of the expense of such cultivation. This seems clear and evident, *to all farmers* at least. "If (such is their language) I lay down my land to pasture, you will not receive one-tenth part of the tithes you now take: what sort of right then have you to the tithes that are produced by expensive cultivation?"

If a field of pasture, the produce of which is worth five shillings per annum, is broken up and improved by draining, &c., at an expense of 15*l.* or 20*l.* per acre, and in consequence, produces an annual return of 5*l.* per acre, can there be any reason or justice in the church's having a right to demand and receive twenty times the sum she received when the land was in poor sheep-pasture? Surely not: for it is the great expense of artificial cultivation, that the farmer has been at, which has produced this great return. The land is worth little, if any more, to the landlord than before; and if the supposed new mode of cultivating it were to be discontinued, it would return to its original value.

RENT AND PROFITS.

The rent of land and the profits of the farmer arise from the excess of the value of the produce over the expense of cultivating it,—the rent belonging to the landlord, and the profits to the farmer, in return for his capital, and for his skill in farming. When all circumstances, connected with agriculture, are in *a natural state*, the price of labour and the expense of cultivating the soil will rise and fall, as the price of the produce of the soil rises and falls. But the impolitic interference of government with circumstances that bear upon the price of produce, has had the effect of lowering the price of produce, without, at the same time, lowering the price of production. Hence a great portion of the poorer soils has been thrown out of cultivation, because the expense exceeded the price of all the produce. Such has been the case with respect to all the poor, thin, clay land of Beverston farm; which is now employed in breeding young cattle, there being little expense attending this mode of reaping the natural yearly produce of it. The rents have thus been greatly reduced, the profits have almost entirely disappeared, and left the agriculturist to live upon his capital. Unable to cultivate his land in the way he was accustomed to do, he endeavours, by cross-cropping it, or cropping it out of the regular course, to make up by increase of crop the deficiency of the price,—a mode which has the effect of ultimately diminishing the produce and impairing the powers of the ground, which gets worn out and overrun with weeds; so that the expense of putting it "in place," or in good

condition again, will be much greater than what would have kept it in good condition.

Thus, the instability of our corn-laws, and of the circulating medium of the country, has not only destroyed much of the property of the agriculturist, but has paralyzed the farmer's operations, deteriorated the quality of the soil, and made the agricultural improvements of this kingdom retrograde, to a degree unprecedented in the annals of agriculture. It has undone all the improvements that have been made since 1796.

The present distressed state of agriculture is felt by every one connected with it either directly or indirectly. The labourer is distressed, because there is no demand for his labour;—the farmer, because the price he gets for his produce does not enable him to meet the demands upon him;—the landlord, because the rent which he now receives will not enable him to support that rank in society which he used to hold, while he views with dissatisfaction the elevation which the money capitalist has attained in consequence of impolitic interference with existing laws.

It is only by descending from the character and standing in society which they held previously to 1820, and by the strictest economy and most industrious habits, that the farmers can now get both ends to meet; for, although their rents are lowered, yet their expenses, together with the growing evil of the poor-rates and other parochial taxes, are as great in all parishes, and in those adjoining the manufacturing districts they are much greater.

ACCOUNTS.

The mode of keeping the accounts on this farm is simple and correct. All payments of rents, tithes, poor-rates, taxes, tradesmen's bills, &c., are entered as they are made, and the expense of labour is entered weekly. This forms the account of disbursements. In the weekly account for labour, the number of hands employed—the wages they receive, whether by the day or the piece, with the kind of work they are employed in, are all entered, so that the expense of the turnip crop, the hay harvest, the corn harvest, paring and burning, &c. for any year, may be known at a glance.

A separate account is opened for the receipts. In this account an entry is made of everything as it is sold, specifying the persons to whom and the price at which it is sold,—also the quantity whether of sheep, beasts, cheese, butter, corn, &c. This forms the account of receipts; and the balancing of this with the former shows the profit or loss of any year.

A GLOUCESTERSHIRE VALE-FARM.

DESCRIPTION OF THE VALE OF GLOUCESTER AND BERKELEY.

Between the Cotswold hills and the river Severn, there is a tract of low country, extending in length from Thornbury to Evesham, a distance of about forty miles; and of various breadths, from four to about ten miles. The surface of this district slopes gradually from the foot of the Cotswold hills to the Severn; and although its uniformity is considerably broken by several detached hills of the oolitic formation, separated from the main body; yet, in its general aspect, it may be said to be a level district. It is statistically divided into the vale of Gloucester and the vale of Berkeley.

The sub-soil of this district is the blue lias-clay formation. Its course through this county is very irregular and intricate, being bounded on one side by the waving line of the Cotswold hills, following the oolite up the valleys in all their windings; and being broken on the other by deposites of calcareous gravel.

The soil, on this formation, which is formed of clay with a mixture of vegetable matter in a decaying state, is very various, and is more or less productive according to the quantity of dead and decaying vegetable matter it contains. In some places, where it has been long pastured, and where a considerable portion of vegetable matter is mixed with it, it produces the richest pasture; but on other parts, it is very tenacious, poor, cold, and sterile; and better adapted for pasture to young stock than for dairy cows or tillage.

The whole of this district being inclosed with hedges, having a great quantity of hedge-row timber in them, it has the appearance of being thickly wooded, as, indeed, it is in many places. The climate is not so early as might be expected, owing, we believe, to its clayey sub-soil. Harvest is about as early on the Cotswold hills as in the vale, although they are at least six hundred feet above it. Dairy-farming is the universal pursuit in the vale.

DESCRIPTION OF THE FARM.

The farm of Frocester Court contains between four hundred and five hundred acres, about four hundred of which are in old pasture. It lies in the vale of Berkeley, at the foot of the Cotswold hills, about eleven miles from the city of Gloucester, eight from the town of Berkeley, and five from the river Severn. Its general aspect is towards the north, having Frocester hill, part of the Cotswold range, on the south of it, from the edge of which it reaches about two miles from the river below. It is all inclosed with hedges and ditches. The hedges are for the most part broad, and composed of black and white thorn, hazel, &c. These hedges are very old, and probably have been formed by being left, when the ground was first cleared from its natural wood, with which the whole of this vale seems once to have been covered.

The soil is of two kinds. The one of these, on the sand formation, which lies above the blue lias clay, is of a light sandy nature, of a brownish colour, containing a considerable portion of vegetable matter, and naturally producing ferns, and good, sweet herbage. Its distance from

the farm buildings, and its elevation, being upwards of three hundred feet above them, induce the farmer to keep it in constant pasture for sheep and young beasts.

The second kind of soil, which is upon the blue lias clay, is of various depths, and contains an admixture of vegetable mould and clay, thickly interwoven with fibre in a decaying state, decreasing in quantity as the depth of the soil decreases. The whole of this soil, where it is deep, appears to be full of vegetable matter, and where it is dry, or on a bed of calcareous gravel, it produces a most abundant herbage of the richest quality, which varies in its nature and richness with the nature and depth of the soil. A great portion of decaying vegetable matter in the soil would, therefore, seem essential to the production of rich pasture. The fields, which are nearest to the home-stead, have been pastured from time immemorial. Some of these, having a sub-soil of calcareous gravel, and being naturally dry, their herbage is of a quality superior to that of the rest of the farm, and they are thickly covered with the finest and most nutritive grasses.

The farm buildings are situated at the north-west side of the farm. These are a good dwelling-house, a dairy-house, feeding stalls for twenty-five beasts, two shades, several courts, stables, and a barn two hundred feet long and thirty wide, built about 600 years ago, and now used as a store for the best hay.

MANAGEMENT OF FIELDS.

The principal object of the dairy-farmer in the management of his fields, is the production of good pasture and hay for dairy-cows, and for raising as many young cows as will be required to fill up the place of those, which either from age or casualties fail in being productive milkers.

It is generally thought that grass-land should be pastured and mown alternately; and when the ground is never manured, this would seem to be the best way of managing it, unless, as is the case in most farms, there are certain grounds, which, when pastured by cows, produce not only much the greatest quantity of milk per cow, but also much the greatest quantity of cheese per gallon: these grounds the intelligent farmer will select for pasture to his cows in prefercnce to all the others. Hence, on most dairy-farms, there are grounds that are always pastured, being those that are most productive of cheese, and, for the most part, nearest to the home-stead. Of course there are, on such farms, other grounds, which are mown every year. With respect to these we would remark, that as, though frequently manured, they are sometimes apt to be overrun with yellow-rattle, a biennial weed, they should be pastured for, at least, two years in succession, and the ground should be skimmed over with the scythe, when the weed is coming into flower. This would completely extirpate it.

The poorest fields of this farm are seldom or never allowed to be pastured in the spring, as it throws them far back at harvest-time. Some of the fields that are manured, are generally kept for pasture for the sheep in the spring, upon which they are folded, and get a fresh portion of the field every day, by which means the grass is eaten up clean. When there is a scarcity of keep, this is sometimes continued till the middle of April or beginning of May, when the ground is cleaned, and shut up for hay.

Draining.—The whole of this farm has been drained. The draining plough has been resorted to, where the sub-soil of clay is near the surface;

and, in pasture land, where the plough reaches the clay, this mode is both the chespest and the most effectual. Turf-draining answers well, where the turf is strong enough to bear ramming; and where it is not, stone or draining tiles answer the best, but they are both more expensive than turf-draiuing.

Manure.—From the small quantity of arable land on this farm, there is very little straw raised, and none of it can be spared for litter to the cows, when foddered in the several courts. The dung, therefore, that is collected in the court-yards is of the richest description, the whole of it having passed through the stomachs of the animals. It is frequently mixed with earth and the scourings of ditches, and is always carried to the mowing ground in the beginning of winter—in the time of a frost, if possible, that the turf may not be injured by the hauliag of it over the ground.

The land which is pastured by cows is never manured, manure imparting a rankness to the grass, which not only gives a rank flavour to the cheese, but also makes it 'heave' or ferment, which is injurious to its quality.

There beiag a great deal of dung collected on this farm, the mowing ground is generally manured once in two years. The dung being spread over the ground with hay forks, is brushed into the ground, the first fine weather in February or March, with a brush-harrow, made of a heavy gate, between the rails of which thorns are fixed, and which is generally loaded with a log of wood. This brush-harrow is drawn over the ground by a borse, going at a very quick rate; and after it has done its work, all the stones and sticks are picked off the ground, whicb is then rolled and harrowed up for mowing.

Dressing or cleaning up the Ground.—About the first of March, or earlier, if the weather is dry, they begin on this farm to clean up the pasture as wcll as the mowing grounds, and to 'hain' or shut them up, either for mowing or for the dairy-cows to be turned into in the end of April or first week in May. This operation is performed by men, women, or boys, with the common hay-fork, which with the back downwards, is swung right and left upon the dung, which the beasts have dropped during the time they were foddered in the field, aud also upon the molehills, which by this operation are beat into small pieces, and at the same time, scattered over the ground, or rather rubbed into it. The waste hay, all straw, stones, sticks, &c., are picked up and carried off the ground, before it is rolled, in the end of Marcb or beginning of April. The fields, wben thus cleaned, are shut up, whether they are for mowing or pasture; and thnse grounds that are to be the latest mown are the last that are cleaned and shut up.

All the rough grass, which the cows do not eat, is mown off, and the weeds cut up once or twice a year. The rank grass produced on those spots on which dung has been dropped in the spring the cows do not eat, and it is 'skimmed over' or muwn, and made into hay for young stock in the winter. From these spots, after heing mown, there springs a new crop in autumn. If they were not mown, the long grass would decay and get rotten at the bottom. These tufts of rank grass are, however, sometimes left, and eaten up by store stock in winter.

Hay.—The age or state of ripeness, at which a crop of grass is cut for hay, is of great importance, for on it depends the quality of the hay. The

earlier it is cut, the better will be the quality of the hay, and the greater will be the quantity of the after-grass; and the longer it stands before it is cut, the greater will be the quantity of the hay, but it will be of an inferior quality, and the after-grass will be diminished in a much greater proportion than that in which the hay is increased. Early mowing, therefore, is always practised on this farm. The mowing begins the last week of May or the first week of June, when the grasses are in blossom, and when they are seldom more than six weeks old.

The mowing should be so performed, that neither the strokes of the scythe nor the junction of the swaths can be discerned. This is easily accomplished by fixing the scythe to the handle, so as to have it level with the ground during the operation of mowing, by not taking on too wide a swath, and by making the scythe come out a little beyond the standing grass every time.

The more expeditiously grass is converted into hay, and the more of the natural juices of the grass the hay retains, the better is its quality. It cannot be too often tedded or shaken abroad, while passing from a state of grass to a state of hay, particularly in the first stages of the process. The hay-machine, therefore, is of great advantage in the work; for besides that a boy and a horse can, with it, do as much work as eight men, it does the work with more expedition and much more perfectly, all the grass being completely separated and spread regularly over the ground to dry; and the hay, in consequence, is at least ten per cent. better in quality than that which is made by the hand.

The hay, in three or four days after mowing, if the weather is favourable, is either put into wind cocks or carried to the rick. The ricks of hay are made in those fields which are dry, and in which it is intended to fodder some of the stock during winter. The best hay is taken to the home-stead, and either ricked in the yard or put into the large barn formerly mentioned, in which several hundred tons of hay can be secured.

STOCK.

Mr. Drinkwater S. Hayward has rented this farm for thirty, and his family for many years. He keeps a pack of a hundred cows, composed of the best milkers, or those from whose milk the greatest quantity of cheese is made; and in selecting calves for weaning to keep up his stock, he takes those of the best milkers. His stock is of a mixed breed; and that which he prefers is a cross of the Gloucester and the Alderney with a Durham bull, producing a stock half Durham, one-fourth Gloucester, and one-fourth Alderney. Having had the good fortune to get an excellent milker of the true Hereford breed, a very uncommon thing, he is proceeding in the same way with this cow, crossing first with an Alderney and then with a Durham bull. This stock of course is one-half Durham, one-fourth Alderney, and one-fourth Hereford; he expects it to be of a very superior kind, and not only excellent milkers, but of the finest symmetry and with high feeding properties; and from the present appearance of the stock, there is every reason to think this will be the case.

To keep up his stock of dairy-cows, Mr. Hayward weans thirty heifer-calves every year. Some of those that are weaned before March produce calves when two years and a quarter old, and all the others come in at three years old. Mr. H. has, therefore, a hundred cows, thirty heifer-calves, thirty year-old heifers, thirty two-year-old heifers, and thirty three-year-old heifers; which last take the place of thirty cows that are yearly drawn from the stock, and disposed of. These thirty cows consist of such heifers as have slipped their calves, or have proved 'empty' or barren,

and of aged cows, which are sold to graziers. The young cows are disposed of as soon as possible; but the old ones are kept as long in autumn as their milk will pay for their keep.

Management of Cows.—The cows are generally turned out to grass in the end of April or beginning of May, upon those grounds which Mr. Hayward has found, from experience, to produce the most and the richest milk. These grounds are nearest to the home-stead, and have always been pastured. The driving of the cows before milking, and the carrying of the milk to any considerable distance, are found to injure the quality of the cheese; and to avoid this consequence, the pasture-grounds should always be, as on this farm, near the home-stead.

The cows, on this farm, are divided into three lots, the young and weak ones being in one lot. Each of these three lots has two fields of pasture, and they are generally kept a week at a time in each field; so that they have fresh pasture every week—an advantage much greater than most farmers are aware of. Great care is taken never to overstock the pasture of the cows. They ought, at all times, to have a full bite of close, short, fine grass. Long overgrown grass gives a rank flavour to the cheese, and should always be avoided.

In dry seasons, when the pasture has got too short, some of the fields that were intended for mowing are given up to the cows for pasture. When the hay is all cleared off the mowing grounds, and the after-grass begins to grow (it generally takes several weeks to make much appearance), the cows are shifted into these grounds. Land which is long pastured by any animal gets foul or unsound for it, and the after-grass always makes the cows spring their milk. They are, therefore, generally moved from the pasture grounds into the after-grass before there is much of it for them.

It is very essential for cows to have a shade and water in every field. The shade of large trees, however, is the only shelter from the sun and the storm, which they have on this farm, and indeed in the whole vale.

Cows should, in winter, be kept as warm and comfortable as possible. Every dairy should be provided with shades and warm courts for the cows; but in the vale there is scarcely an instance of accommodation of this kind for one-fourth of the cows, and there is not more on this farm. Hence most of them are foddered in the dryest and warmest grounds; and before calving, they get hay served out to them morning and evening; but after calving, they are fed three or four times a day, and with the best of the hay.

Calves.—The calves are allowed to remain with their mothers for about a week after they are dropped, because the milk, during this time, would not do for making cheese. The best of the heifer calves are selected for breeding. Such of the remainder as are dropped before March are fattened; those that are dropped after that time are sold young, as, then, veal generally becomes cheap, and milk is of more value for making cheese than for feeding calves.

After the first week, the calves that are to be weaned are parted from their mothers, and put on the calves' stage, a sort of crib erected in the calves' houses, which being raised one foot from the ground, and being open in the bottom, keeps them dry without the help of litter. Here they are allowed two quarts of sweet milk in the morning, and the same quantity in the evening, for the first six weeks. At the end of this period they begin to eat hay, some of the best of which is given to them; and,

instead of milk, they get a mixture of sweet milk and water. They are turned out into some of the earliest and best pasture, as soon as there is any for them.

The whole breeding stock are distributed into lots, according to their ages, and kept apart summer and winter. They are kept either on the upper field of this farm, or taken to another farm on the hills, where they are treated in the same way as the breeding stock are on Beverston farm.

Sheep.—There are upwards of three hundred sheep kept on this farm. They pasture the upper field in summer; and in autumn and winter they eat up the rough grass left by the cows. The management of the sheep is the same as that practised on Beverston Farm, to the account of which we refer the reader.

Pigs.—Upon this and every dairy farm a number of pigs are necessary to consume the whey,—one pig to two cows in summer, but not so many in winter. Their food, in summer, is grass, clover, vetches, and whey; in winter, raw potatoes, with tailing corn, whey, and skimmed milk. When they are being fattened, bean or barley-meal is mixed with boiled or steamed potatoes, in the proportion of a bushel of meal to two cwt. and a half of potatoes. The breed of pigs kept on this farm is the Berkshire, with a small mixture of the Hereford. Some of them are sold in a store state; most of them are fattened. Five or six breeding sows are always kept, which are regularly fattened off, when one year and a half old, and fed to about three cwt.

MANAGEMENT OF THE DAIRY.

It is acknowledged by every one, at all acquainted with the subject, that the quality of cheese does not depend upon the superior richness of the soil or the fineness of the herbage; for cheese of the first quality is frequently made from land of an inferior description, and from herbage of a coarse nature. Nor does the quality of the cheese depend on the breed of the cows, for cheese of the best quality is made from the milk of cows of all the different breeds that are to be found in the country;—we think it principally depends on the management of the cows as to their food, &c., of the milk in converting it into cheese, and of the cheese, till it is fit for market.

The following circumstances are injurious to the quality of cheese:—allowing the cows to get rank or ill-flavoured grass or hay, these conveying a bad flavour to the milk and cheese;—allowing the cows to run and heat themselves;—driving them far to be milked, which makes the milk froth much in milking;—carrying the milk from the place of milking to the dairy; and allowing it to remain long after it is milked, before it is set with the rennet.

The greatest dependence is upon the dairy-maid; and the chief art of making cheese of the finest quality lies in her management. The superintendence of the dairy invariably devolves upon the farmer's wife. Mrs. Hayward attends to every minute circumstance in this department, and the following is a report of the information she has obligingly communicated to us respecting the whole economy of the dairy of this farm.

The management of a dairy should be conducted with the greatest regularity. Every operation should be performed precisely at the proper time. Either hastening or delaying the execution of it will cause cheese of an inferior quality to be made of milk from which the best may be obtained. A dairy-maid is selected for skill, cleanliness, and strict atten-

tion to her business. Her work commences at four o'clock in the morning, and continues without intermission till bed-time.

Dairy-house.—The dairy-house should be kept at a temperature of between 50° and 60°; and the dryer it is kept the better, as both milk and cream retain their sweetness much longer in dry than in damp air. Every time, therefore, the dairy is washed, it is dried as quickly as possible.

Around two sides of the dairy there are broad shelves, made of elm, for putting the vessels that hold the milk and cream, and the newly made cheese upon. On another side there is a frame with three large stone cheese-presses. In the middle of the north side is the door; and in the corner, on the left, is the stair leading up to the cheese-lofts; and behind the door is a single cheese-press, which is generally used in pressing the cheese the first time, before it is cut down and put through the mill. In the middle of the floor stand three leaden vessels, large enough to hold all the whey of one "meal" or milking; and by the side of these stands the cheese-tub.

Above the dairy there are two cheese-lofts, around the sides of which there are broad shelves for holding cheeses; and in the middle stands a frame for holding two rows of boards, called here "cheese-tack," which being only about eight inches apart, contain a much greater quantity of cheese than could be disposed on the floor. The stair to the cheese-lofts is of oak, and seems to be the pride of the dairy-maid, for it is dry rubbed and polished so smooth that it is dangerous to walk upon; but this sort of pride is encouraged as evincing an attention to cleanliness.

Along the north side of the dairy there is a shed, which communicates with the dwelling-house. In this shed the utensils are kept upon a stand for the purpose, the cream is churned, and other work performed, nothing being done in the dairy, but the making of the cheese and the making up of the butter.

Opposite to the door of the dairy and detached from the shed, is a wash-house with a pump-well, at the door of it. In this wash-house, the water and the milk are heated in boilers for the purpose; and all clesning work is performed.

Utensils.—The milking-pails are made of maple, on account of the lightness of the wood and its cleanliness of appearance. They hold about six gallons each, and the cheese-tub is of a size large enough to hold the whole of the milk. The ladder, the skimming-dish, and the bowl are of maple. The sieve for straining the milk is about fifteen inches in diameter, and has a hair-cloth bottom.

There are a number of cheese-vats, sufficient to hold all the cheese made in four or five days. They are made of elm, and turned out of the solid. That which gives five cheeses to a cwt. is considered the best size for double Gloucester, the inside diameter of which is fifteen inches and a half, and depth, four and a quarter; and that is considered the best for single Gloucester, which gives eight to a cwt., the diameter within being fifteen inches and a half, and depth, two and a half. Round boards, called 'suity boards,' made of elm, of the diameter of the cheese-vats, and thicker in the middle than at the edges, are occasionally necessary to place on the cheeses, when in the press, if the vats are not quite full. Without the assistance of these boards, the cheeses will be round in the edges, (a proof of not being well pressed,) and not so handsome.

The cheese-presses are made of stone, as being the cleanest material for

the purpose, and of steadiest pressure. They weigh about seven cwt. each; they are raised by a block and tackle; and the whole apparatus is painted white.

From the whey leads, which are oblong and about eight inches deep, there are leaden pipes which convey the whey into an under-ground cistern, near the pigs' houses, where by means of a pump it is raised, when wanted, for the pigs. Leaden keep the whey longer sweet than wooden vessels, and are much easier kept clean. This is done by scouring them with ashes of wood, and washing them well every time they are emptied, which is every thirty-six hours.

Tin vessels are used in preference to earthenware for holding the milk that is set for cream, and also for holding the cream. Those used for the cream hold about four gallons each, and are made with a lip for the convenience of shifting the cream from one of these vessels into another. This is done once every day during summer; and there is a wooden slice or knife always kept in the cream vessel, with which the cream is frequently stirred during the day, to prevent a skin from forming on the top of it, which is injurious to the quality of the butter. The skimming-dish, used for taking the cream off the milk, differs from that used in cheese-making, being made of tin, with holes in it, to let the milk run out that may be taken up with the cream.

The butter-scales, prints, and butter-boards are of maple. The boards for making up the butter in half-pound rolls are about one foot long and nine inches wide. The barrel-churn is made of the best oak, and great attention is paid to its cleanliness. The butter-milk is never allowed to remain in it; but it is washed, scalded, and put up to dry, as soon as the butter is taken out.

Milking.—This is performed in three separate courts, to which the cows come from their several fields. The milkings should be as near as possible at equal divisions of the day, commencing at about four o'clock in the morning and three in the afternoon. To each milker eight cows are assigned, and one man carries the milk from all the milkers to the dairy. The milking should be finished in an hour. The dairy-maid sees that the milkers do their duty, and that all the cows are milked clean; for the milk that comes last is the richest; and, besides, if the cows are not clean milked, there will be a gradual diminution of the milk, perceptible daily: for these reasons the greatest care is taken that the cows are clean milked.

Cheese Making.—The cheese-tub being put in its place in the dairy, the ladder is put across it, and a large thin canvass cloth covers the whole tub and ladder to catch any of the milk that may drop from the pail, and to prevent dirt from falling into the tub. Above this and upon the ladder is placed the sieve, through which the milk is strained. If the milk should not be of the temperature of 85°, a portion of it is put into a deep tin, kept for the purpose, and placed in a furnace of hot water in the wash-house, by which means the whole is warmed to a proper degree. It is of the utmost moment to attend to this; for if the milk is not warm enough when the rennet is put into it, the cheese will be 'tender,' and will bulge out in the edge, which spoils its appearance, and a great quantity of sediment of small curd will be found in the whey leads, which is so much curd lost. If, on the other hand, the milk is too warm, it will cause the cheese to 'heave' or ferment, which injures both its appearance and quality.

When the milk is sufficiently warm, the colouring and the rennet are

put into it. The colouring or anatto is put in by rubbing a cake of it on a plate amongst the milk until, from its appearance, it seems coloured enough. One pound of anatto, at five shillings, is sufficient for half a ton of cheese.

The rennet being added immediately after the anatto is put in, the tub is covered with a woollen cloth for, at least, an hour.—Rennet or runnet is made from the stomachs of calves, called here 'vells.' Irish vells are the best: they are cured, and sent to England, and sold by the grocers to the dairy-farmers. Mrs. Hayward never uses them till they are twelve months old, for, if they are not old, the rennet made from them causes the cheese to 'heave,' and to become full of 'eyes' or holes. She prepares the rennet from them by adding to every six vells two gallons of brine and two lemons. The lemons do away with any disagreeable smell, and give the rennet sweetness and agreeable flavour. Twenty or thirty gallons of it are made at a time, as it is found to be much better, when made in large quantities. It should never be used, till it has stood for, at least, two months.

When the curd is sufficiently firm for breaking, it is gently and slowly cut with a three-bladed knife, down to the bottom of the tub, (the knife being about fourteen inches long,) both ways or at right angles, and around the sides of the tub. The cuts should be about an inch apart. When it has stood five or ten minutes to allow it to sink a little, and the whey to come out as clear as possible, some of the whey is dipped out of it with the bowl, and the curd is cut a second time with the three-bladed knife—very slowly to begin with; for, if the cutting is done hurriedly, a great sedimeat of very small curd will pass through the sieve and be found in the whey leads, and there will also be an increase of the quantity of whey butter which should have been in the cheese, and the value of the butter, thus obtained, will not compensate for the waste of curd, and for the loss of credit which the cheese will sustain from the abstraction of butter from it. The cutting being, therefore, performed very slowly at first, and with the strokes of the knife at a considerable distance from each other, is gradually quickened, and the strokes are taken nearer and nearer every time. At last, one hand, with the skimming dish, keeps the whole in motion, turning up the lumps suspended in the whey, while the other, with the knife, is in constant motion, cutting them as small as possible—and this operation is continued till no more lumps are brought to the surface, and the whole mass is reduced to one degree of fineness. This process may occupy a quarter of an hour.

The curd is now allowed to stand a quarter of an hour, and being, thus, sufficiently settled, the whey is taken from it with the bowl, and poured through a very fine hair sieve, placed over the whey leads. When the greatest part of the whey has been separated from it, the dairy-maid, folding over a portion of it, and beginning at one corner, goes around the tub, cutting the curd into lumps, and laying them on the principal mass, by which operation the mass is carried all around the tub, and most of the remaining whey escapes between the cut fragments, as they lie and press upon each other. From time to time the whey is taken from the tub, and put through the sieve into the whey leads.

The curd is then put into vats, and pressed down with the hand. The vats, being covered with cheese-cloths, about one yard and a quarter long, of fine canvass, are placed in the press for half an hour, when they are taken out and the curd cut into slices, and put into a mill fixed on the top of the tub, which *tears* it into very small crumbs, as small as vetches. This mill, which is of Mr. Hayward's construction, is a great improvement in the making of cheese, not only as it saves the dairy-maid the most

laborious part of the process, that of squeezing and rubbing the curd into small crumbs with her hands, but as it allows the fat to remain in the cheese, which the hands squeeze out.

In its pulverized state, it is customary with most dairy-maids to scald the curd with hot whey; but Mrs. Hayward considers cheese richer, when made without scalding the broken curd, this washing the fat out of it. She, therefore, without scalding it, puts it into the vats, and presses it closely together with the hand, in filling them. In making double Gloucester cheeses, particular care is taken to press any remaining whey from the curd as the vats are being filled, and they are filled as compactly as can be done with the hand, being rounded up in the middle, but just so much so, as that the whole can be pressed into the vat. Cheese-cloths are then spread over the vats, and a little hot water is thrown over the cheese-cloths, which tends to harden the outside of the cheese and prevent it from cracking. The curd is now turned out of the vats into the cloths, and the vats being dipped into the whey to wash away any crumbs of curd that may cling to them, the curd, inverted and with the cloth around it, is again put into them. The cloths are then folded over and tucked in, and the vats, as they are filled, are put into the press one upon another. The bottoms of the vats are smooth and a little rounded, so as to answer the purpose of cheese-boards, which, therefore, are only wanted for the uppermost vats, or when the other vats are not quite full. The vats are allowed to remain under the press about two hours, when they are taken out and dry cloths are applied, which with double Gloucester cheeses should be repeated some time in the day.

Salting and Salting-presses.—The vats, when the clean cloths are given, as just mentioned, are changed from the single press to the one next to it, and placed in it, one upon another, as before. They remain in this press till the cheeses are salted, when those made in the evening take the place, in the press, of those made in the morning, and those made in the evening are, in their turn, displaced by those made the following morning, the cheeses of the last making being always placed lowest in the press, and those of the other makings rising in it according to the priority of making. The same order is observed in the other two presses, the last or newest making in each being lowest, and each making having next above it that which was made last before it. The cheeses pass through the three presses in this order, advancing a step in their progress at each ' meal ' or making, till, at last, in four or five days, they come out of the presses and are put upon the shelves. They are generally salted at the end of twenty-four hours after they are made, though this is done by some at the end of twelve hours. The salting should never be begun till the skin is all closed, for if there be any crack in the skin of the cheese at the time of salting, it will never close afterwards. The salting is performed by rubbing with the hand both the sides and the edge of the cheese with finely powdered salt. The cheese, after this, is returned to the vats, and put under the press, care being always taken, according to what has been said, to put the newest cheese lowest in the press, and the oldest uppermost. The salting is repeated three times with the single, and four times with the double Gloucester, twenty-four hours being allowed to intervene between each salting. After the second salting, the cheeses are returned to the vats without the cloths, that the marks of the cloth may be effaced, and the cheese may get a smoothness of surface and ' keenness of edge, which is a peculiarity of Gloucestershire cheese. The double Gloucester remain in the presses five days, and the single, four; but in damp

weather they should remain longer. The quantity of salt generally used is about three pounds and a half to a cwt. of cheese.

The Cheese Room.—When the cheeses are taken from the salting-presses, they are put on the shelf in the dairy for a day or two, where they are turned once in twelve hours. They are then taken to the cheese-loft to make way for the new ones. In the cheese-room, either on the floor or on the 'cheese-rack,' they are turned once every day; and, in general, in a month from the time they were taken out of the vat, they are ready for cleaning, which is done by scraping them with a common knife. The dairy-maid, in doing this, sits down on the floor, takes a cheese in her lap, and with the knife scrapes both sides and edge clean, taking off all scurf they may have contracted. The cheese, if intended for the London market, as is generally the case, when it has been thus cleaned, is rubbed all over with a paint made of Indian red, or of Spanish brown, or of a mixture of both, and small beer. It is rubbed on with a woollen cloth. After being painted, it is turned over twice a week, and oftener in damp weather; and, as soon as the state of the paint will permit, the edges of the cheese and about an inch of each side is rubbed hard with a cloth, at least, once a week.

Characteristics of true Gloucester.—The marks of true Gloucester cheeses are,—'the blue coat,' which arises through the paint on their sides, and which is a sure sign of their richness and sweetness,—the yellow, golden hue of their edges,—a smooth, close, and wax-like texture,—a very mild and rich flavour,—not crumbling when cut into thin slices, nor parting when toasted, with the oily matter they contain, but softening, without burning. If cheese has been soured in the making, either from being too long in hand, or from want of attention in scalding the utensils, nothing will cause it to assume the blue coat. If the curd is salted, when ground down before being put into the vats, the salt has the effect of giving a skin to each of the particles of the curd it comes in contact with, which prevents them from intimately uniting; and, although the curd may be pressed together and become good cheese, yet it never becomes a smooth, close, solid mass, like that which is salted after it is made, but is of a loose texture, and crumbles when cut; and although it may be equally fat, yet, in toasting, the fat melts out of it, and the cheesy part burns. The skin of the cheese, too, is not tough and solid, but hard and brittle, and, when examined, seems to be formed of many irregular portions, something like mosaic work.

Making of the Butter.—The milk, as it comes from the cows, is strained through a hair-sieve into the tin vessels, which are about four inches deep. It is allowed to stand only twelve hours, when the cream is taken off with the skimming-dish and put into the cream vessels, and the milk is warmed and carried to the cheese tub. The cream is shifted into fresh cream vessels once a day, and is also stirred frequently during the day with the wooden knife, that is always kept in each of the cream vessels. This continued shifting and stirring of the cream prevent a skin from forming on the top of it, which is injurious to the butter.

In summer or in hot weather, several gallons of cold water should be put into the churn, and allowed to remain an hour in it to cool the churn, before the cream is put into it. The cream is strained through a coarse canvass cloth kept exclusively for this purpose, and then put into the churn. The operation of churning should, in summer or in hot weather,

be very slow, otherwise, the butter will be very soft when taken out: but in winter or in cold weather, and particularly in frosty weather, the churn should be prepared for receiving the cream by putting hot water into it, and allowing it to remain for half an hour to heat the churn; and, then, the operation of churning should be performed quickly, and now and then the air, that escapes from the cream in churning, should be let out of the churn, or it will make the cream froth, and lengthen the process of churning very much.

When the butter is taken out of the churn, it is customary with most people to wash it with cold water before salting it. This is never done here, Mrs. Hayward having found from long experience, that butter retains its sweetness much longer when no water is used in making it up. When it is taken out of the churn, it is well worked with the hand, which presses out most of the milk; it is then beaten with a cloth, or rather, a cloth is repeatedly pressed down upon it, which absorbs all the remaining milk. When this is properly performed, and no trace of buttermilk remains, it is salted to the taste with finely powdered salt, which is well mixed with it by working it in with the hands. It is then weighed into half-pounds, and made up in rolls, about nine inches long. The process of making butter from the cream of whey is the same as that just described. Butter is made twice a week during summer.

The quantity of milk butter made on this farm is about 16lbs. per cow, and that of whey butter about 25lbs. per cow per annum. About $2\frac{1}{4}$lbs. of salt are used to a cwt. of butter.

Comparative Estimate of the several applications of Milk, viz., to the feeding of Veal, and to the making of Cheese and Butter.

In feeding calves for the butcher, it generally takes seven weeks to feed them to about a cwt. each; and they consume the following quantity of milk in the seven weeks:—About 10 gallons the first week; 16, the second; 20, the third; 24, the fourth; 27, the fifth; 30, the sixth; and 32, the seventh; so that, it takes 159, or say 160 gallons of milk to produce 112lbs. of veal. The average money value of the above modes of converting milk into a marketable commodity will stand thus:—

100 gallons of milk produce 112lbs. of cheese of the best quality, which at 6*d*. per lb. is	£2 16 0	
and 5lbs. of whey butter, which at 8*d*. per lb. is	0 3 4	
Value of 100 gallons of milk, when converted into cheese . .		£2 19 4
100 gallons produce of milk butter 34lbs. which at 10*d*. per lb. is	£1 8 4	
and of cheese of the worst quality 74lbs, which at 3*d*. per lb. is	0 18 6	
Value of 100 gallons, when made into butter		£2 6 10
160 gallons produce 112lbs. of veal, which at $7\frac{1}{2}$*d*. per pound, is	£3 10 0	
but calves, when dropped, generally sell at 10*s*. each, which being deducted	0 10 0	
leaves, as the value of 160 gallons	£3 0 0	
and therefore, the value of 100 gallons in feeding veal .		1 17 6

Thus, making cheese of the first quality is more profitable than either making milk-butter or feeding veal; yet many farmers continue to feed calves during the early part of the spring—a practice not justified by an examination of results, but persevered in from habit, as many practices are, where active pursuits are not conjoined with a spirit of inquiry and comparison.

EAST RIDING OF YORKSHIRE.

FARMING AT SCOREBY,

ON THE ESTATE OF

OTTIWELL WOOD, Esq.

Communicated by Mr. Charles Howard, Melbourne, York.

February 25, 1832.

'And the Lord God took the man, and put him into the Garden of Eden, to dress it, and to keep it.'—Gen. ii. 15.

INTRODUCTION.

The East Riding of Yorkshire, which contains above 800,000 acres of land, is a purely agricultural district. In this view it may be divided pretty equally into three natural parts. The first of these extending along the sea-coast, and the rivers Humber and Ouse, consists generally of a description of strong and very fertile soil, suitable for the growth of beans and wheat; this includes Holderness and Howdenshire. The second division occupies the whole centre of the East Riding; it is an elevated chalk and limestone soil, called 'The Wolds.' This is admirably adapted for the growth of barley, turnips, and white clover. Hence it is with great propriety chiefly employed in rearing and fattening large flocks of sheep; the breed of which is probably not to be excelled in the world. They are descended from the best stocks in Leicestershire, and have retained much of that form and propensity to fatten; whilst by a constant attention to a heavy fleece, they have been gradually led to afford a larger supply of wool. This supposed division of the East Riding intersects for a few miles the first division, as it stretches up to the Humber, about five miles to the west of the town of Hull, and thereby separates Holderness from Howdenshire; it then occupies the whole space between Beverly and Weighton, Driffield, Burlington, and Malton. The third division forms the western boundary of the East Riding, commencing northward along the river Derwent, and extending southward from the banks of the Ouse to the town of Weighton, and joining upon the strong clays in the vicinity of Howden. The soil in this division is exceedingly variable. A considerable proportion of it may be termed poor, though it contains every variety of clay, loam, gravel, and sand. The climate is mild; it is rich in timber, and includes on the extensive estates of Beilby Thompson, Esq., M. P., oak woods and hedge-row oak timber which cannot be surpassed in the north of England. It is

also favoured by great facilities for water carriage, deriving, in different parts, advantage from the rivers Ouse and Derwent, and three canals, called the Foss, the Pocklington, and the Weighton canals. It possesses a considerable quantity of valuable meadow land along the margin of its rivers and brooks, constantly fertilized by their overflow in the winter; though subject to an occasional loss of crop, arising from the same cause in summer. The roads are good; it is chiefly enclosed, and but little pestered by that bane to improvement—tithe. Yet with all these advantages, the farmer has to contend with a soil not generally fertile; and much injured by the prevalence of superabundant moisture. It is from this third division that I have selected an estate for description, which may be considered to furnish an average of the soil and mode of farming around it, possessing all that variety of character which distinguishes the western boundary of the East Riding of Yorkshire; at the same time that it will afford an opportunity of making more extensively known, the practice of some branches of rural management, which has been found highly advantageous, though not in common use.

DESCRIPTION OF THE ESTATE OF SCOREBY.

Scoreby, is a small township, containing about 1300 acres, the property of Ottiwell Wood, Esq. It is situated six miles east of the city of York, its southern boundary approaching very near to the road leading from that city to Hull, and its eastern one extending for two miles on the western bank of the navigable river Derwent. It is divided into six farms, from 120 to 220 acres each, and it contains about 200 acres of woodland, chiefly oak.

TENANTS' TENURE.

The leases are drawn up merely for two years in the first instance, and forward from year to year, until six months' notice to quit shall be given by either party. The entrance is solely at Lady-day, excepting on such fields as are in course for a spring crop or fallow, which are given up on the 2d of February. The manure is, as it ought always to be, the property of the landlord; and is entered upon, and left by the tenant, without purchase. The tenant covenants to scour out all his ditches and drains annually; to cut the fences where requisite in a workmanlike manner, and when cut, effectually to secure them from being injured by the pasturing of cattle. Also to concur with his landlord in the protection of the game; and to furnish annually a team, in the proportion of ten days for every £100 rent,—either to carry gravel for the private roads used by the tenants, for leading off heavy banks, which accumulate on the side of the drains, or such other general improvements upon the estate, as the landlord may direct. This clause has been found by experience to be highly serviceable, both to the estate and to the occupiers: it has been the source of much improvement on the roads, and in the drainage. Great care is taken to avoid oppressing the tenants, by calling for their teams when they are particularly required for forwarding their individual farming operations. The covenants for cropping are left as open for the judgment of the tenants, as due attention to prudence will admit. They are bound not to take two crops of white grain in succession; nor more than two crops of any grain, without an intervening fallow or grass ley. Also to sow clover or grass with the first crop after every fallow; and to have, at all times, not less than one-fourth of the farm in clover or grass ley, exclusive of that portion of land which is expressed in the lease to be permanent pasture or meadow

land, and which is protected from the plough by the tenant being subjected to an additional rent of £20 per acre, if converted into tillage. On leaving the farm, the tenant is entitled to the full value of such crops as he may have sown on lands previously and thoroughly fallowed, and manured at the rate of eight tons of good manure; or limed at the rate of four chaldrons of lime per acre. The same privilege extends to the land which may have been used for a turnip or other green crop, whether consumed on that, or upon any other part of the farm. These crops are valued just before the period of harvest. Neither hay nor straw, nor any leguminous or bulbous rooted plants, are allowed to be sold off the estate, unless permission shall have been expressly granted for that purpose; and then it is usually done on condition of bringing back at least an equivalent in town manure.

The buildings, consisting of a substantial farm-house, placed near the centre of each farm, with a barn, stables, cattle-houses, pig-sties, &c. are generally good. The materials used in the erection are brick and tile. The country affords no stone for building; thatch is properly abolished; and slate is too expensive for common use. The barns in the north of England are much smaller than those in the south, and though this occasions a little extra trouble in forming stacks of moderate dimensions, it is amply repaid by the additional sweetness of the grain, and by its being led without injury, in a state which would, by too much succulency, occasion it to heat or ferment, if confined from the air by the walls of a barn. A well-fenced fold-yard, open to the south, and sheltered on three sides by a moderate-sized barn, good stables, and ample cattle-houses, is highly valued, and usually found on all the well-managed estates in this district; indeed, generally in the East Riding of Yorkshire.

IMPLEMENTS.

These from the nature of the country are unavoidably very numerous, and the provision of the smaller ones falls chiefly upon the labourer. He is expected to find his own scythe and reaping-hooks, to be furnished with a common and a clay spade, a shovel, forks, and one or two 'gripping tools' of different breadths. The latter are almost peculiar to this district, made of ash-wood, and shod with iron about four inches deep at the bottom: the customary width of this tool is seven inches, it is admirably calculated for cleaning out ditches, where this work is impeded neither by stone nor clay; and especially for scouring out the surface drains, called here 'grips,' in arable and grass lands.

The plough is of a light construction, and somewhat smaller in size than is usual in other parts of the kingdom. It is invariably made of ash-wood, with a mould board and slips, or strakes of cast iron. The length of the beam is six feet six inches; the length of the poles or handles, including the curves, is six feet; and the total length of the plough from end to end, in a straight line, is about ten feet six inches. The price charged by the plough-makers, for here it is usually a distinct branch of carpentry, is about thirty shillings; this is for the plough fit for use, but not including the shackle, by which it is drawn and regulated, or the coulter. It is sold without these, as they are transferred from the old plough to the new one, or, when wanted, are procured from the village smith. This common plough is drawn by two horses abreast; the average quantity of work done by it, where the land is firm, is about one acre per day, which will occupy eight hours. But on loose land, in the turnip season, it is very general to average full two acres per day, and this is often well done by a lad of

seventeen or eighteen years of age, with a pair of light horses in two yokings of five hours each.

The ribbing-plough was first introduced into this neighbourhood, from Mr. Morton's superior manufactory of agricultural implements at Leith, about twenty years ago, by the reporter, who had witnessed the great advantage which the farmers in the Lothians derived from the use of it. It has now become common in this neighbourhood, and found especially useful for sowing wheat and beans. When the land is prepared to receive these crops by a fallow, it is lightly harrowed to break the plough seam; lines are then formed by the small share of this plough, drawn by one horse, at such intervals and depth as may be required; the seed is sown immediately afterwards broadcast, but falls chiefly into these lines, and what little remains on the ridges is drawn into them by the harrows. The grain is thus deposited at a sufficient and equal depth; it springs up in beautiful straight lines and is readily horse or hand hoed. When the land is in good order, one horse will rib about three acres a day, and considerably less harrowing is required by this, than by the old method of sowing. To perform this work in the most perfect manner, the ploughman should always finish his furrow on his left hand, and thus turn the next furrow to the right, which mode prevents any broken mould from crumbling into it, and filling it up again. The ridge freshly turned up then covers the unploughed ground. The cost of this implement is only about twenty-five shillings, and it may be used in many soils, which from their great diversity in one field, will not admit of the use of the drill.

Waggons drawn by two or four horses abreast, with a pole, are almost invariably employed for carrying hay or corn in the straw, and very much for delivering corn to the market. Indeed, so necessary are they considered, that scarcely any farmer of however small extent is found without one.

Carts are chiefly used for conveying manure, lime, turnips, &c. drawn by one, two, or three horses singly; if the latter are used, it is better to put one into the shafts, and yoke the other two abreast, thus bringing them nearer to their work, and having greater command over them.

The wain, a large cart upon broad wheels, with a pole, and drawn by a pair of oxen, is much used at Scoreby, and is proved by experience to be alike serviceable and economical. Formerly the wain was in universal employ in the East Riding of Yorkshire; and why it is no longer so is difficult to account for. Oxen are unsuitable for rapid motion, but they are capable of drawing great weights, and with a heavy draught we do not find that the pace of the horse much exceeds that of an ox.

The haymaker, a machine invented for this purpose by B. Brooksbank, Esq., of Helaugh, near Tadcaster, on a very simple construction, has long been used by the reporter. It is well calculated for spreading the grass after the scythe on the level meadows, which lie on the banks of the Derwent. A light horse will turn thirty acres of grass in one day with this machine, dividing it most minutely, and far more regularly than it can be done by hand. The cost of this implement is about four pounds.

Thrashing Machines.—There is only one fixed machine of this description at Scoreby; but in the neighbourhood there are several portable ones, which are occasionally used there. These perform their work very well, and are let out to hire at a moderate rate. The owners of them usually charge one guinea a day for the loan of the machine, including their own attendance; and the farmer furnishes horses and men to work it. There is no popular feeling against them in this district.

FENCES.

The fences here are chiefly of quickwood, though in some of the old ones there is a considerable quantity of black thorn, hazel, wild rose, &c. Generally they abound also in oak, which is perhaps of all timber trees the best calculated for growth in hedge-rows, affording the greatest advantage to the proprietor, with the least injury to the tenant. The new fences which have been planted during the last twenty years at Scoreby have had much care bestowed upon them. The land is previously fallowed, and for two or three years after the quickwood is planted, a row or two of potatoes are grown to improve the soil. A ditch is usually made, about three feet wide on one side the fence, but varying in this, according to the drainage required. In some instances the ground has been trenched with the spade to the depth of eighteen inches, previously to planting the quickwood; nine or ten roots are planted in a yard, with commonly an oak in every seven yards. The young hedge is protected by three holed posts and rails on one side, and outside the ditch by a single rail and dead thorns. It is absolute folly to plant a hedge without fully protecting it from the bite of sheep and cattle. The tenants covenant to clean the young fences twice a year, which is essentially necessary to their growth. Considerable advantage is also found to result from clipping the straggling shoots in the autumn with shears, which gives vigour and form to the fence. This is done in October, when the shoot is completed, and the weather favourable for pruning; and by doing it before the winter sets in, the shoots are preserved from being broken by drifted snow.

In cutting old fences more attention ought to be paid to the manner of it than is usually done. The stroke of the hatchet or pruning-bill should be invariably directed *upwards*, otherwise the growing wood will be shattered, which greatly injures it. The oldest stems ought to be cut down about three inches from the ground, others a foot or eighteen inches high, and the remainder about three feet six inches. By this treatment a newly cut hedge is a fence again in one year, and never becomes thin at the bottom. The best time to cut an old fence is, when the field in which it grows is ploughed out for corn, when, if both sides are arable, the work may be completed; but if pastured on one side, this mode of renewing a hedge may be well adopted, by leaving the whole of the 'brush,' *i. e.* the lower branches uncut on the side next to the pasture. It must, however, be acknowledged that the overlooker of an estate in this district, has not a more difficult task than to enforce due attention to the care of fences, both hedge and ditch.

SCOTCH-PALING, neat light fence, peculiarly adapted for gardens, for securing single trees, or for strengthening a weak place in a young hedge, was introduced at Scoreby, from Lanarkshire, by John Wood, Esq., M.P., a few years ago, and is now much used both there and in the neighbourhood. It is formed of larch stakes, or Scotch firs, split into four, say five feet long, and seven inches in circumference. These are driven fifteen inches into the soil by a heavy mallet, holes being previously made with an iron crow. About fifty of these stakes are used for a rood of seven yards. They are confined by a light larch pole sawn in two, the flat side being nailed downwards to each stake. Where the stakes are purchased from a distance, the cost of this fence will be about five shillings per rood; but where they are plentiful, it will be found a cheap, simple, and elegant fence.

FALLOWS.

Fallowing commences usually as soon as the wheat crop is sown, by ploughing the oat and bean stubbles with a large and deep furrow, that the soil may be meliorated by the winter's frost; the land is then laid dry by scouring out the grips. In this state it remains generally until April, when it is ploughed again, and three more ploughings are considered requisite to perfect the summer fallow. The best farmers apply lime or manure early to the fallows, as the more completely either of these substances is worked into the land, the better is the wheat crop that follows. It is not thought desirable to harrow strong clay soils more than can be avoided; the sun and wind penetrate deeper into it when the clods of earth are large, and the root weeds are therefore more effectually and certainly destroyed. Two other advantages result from the land being sown with a 'good clod.' The young wheat is sheltered and protected by it in the winter months; and its falling down before the harrows, or the hoes, in March and April, when the clover or grass seeds are sown, tends materially to benefit the wheat, and effectually covers in the seeds.

Turnip or Green Fallows.—An exertion is often and should always be made to get the land intended to be fallowed for turnips, potatoes, or rape, &c. ploughed, harrowed, and ploughed again, immediately after the harvest. This not only improves the soil, but greatly forwards the work in the spring, when every weed should be eradicated as early as possible. The land for these crops cannot be too minutely divided; the rough clod that has been observed to be favourable to the wheat is highly injurious to these crops. Care is, however, necessary to avoid cutting the 'quicks,' (triticum repens,) with which all light soils, and especially moist ones, usually abound. On this account the land ought not to be ploughed across, and after the first two ploughings, the coulter should be removed from the plough-beam. If the quicks are cut into short pieces, no care can get the land cleared of them in time to sow the turnips; neither can they be totally destroyed by after culture, which the seedling plants may. Exertion is always made to get the fields intended to be sown with turnips thoroughly cleaned, and the fallow completed, two or three weeks before the period of sowing, as they will then, even in the driest seasons, retain sufficient moisture to ensure vegetation. When it is not intended to place the manure directly under the drill, the earlier it is applied, and the more intimately it is mixed with the soil, the better the crop is found to thrive. Long manure cannot be applied for the turnip crop with advantage. The best farmers at Scoreby take from the farm-yard, during the first frost, all the manure which lies near to the doors of the stables and the cattle houses, and lead it to the fields intended for turnips. This is neatly heaped up, and the fermentation that speedily commences makes it sufficiently rotten for use in April.

WHEAT.

It is not considered advisable to sow this crop before the commencement of October, though, if possible, it should be finished in that month. The objection to sowing earlier arises from the luxuriant growth in September of its most formidable enemy, 'the black grass,' (alopecurus agrostis,) which is a very noxious weed. Wheat is here usually sown on a summer fallow, though occasionally after rape,

potatoes, or turnips. It is not found to answer well at Scoreby, when sown upon a grass or clover ley. Too much is yet sown broadcast, though the success is decidedly greater when the drill or ribbing plough is used, the little additional trouble being fully repaid by reducing the expense of hoeing. The intervals allowed at Scoreby, when the drill is used, are too narrow to admit of the full advantage of deep hoeing, not generally exceeding nine inches. It is better to sow at from twelve to fifteen inches apart, as the hoe can then be used more freely, and the newly raised mould in the spring encourages the plants to spread, 'tiller,' and shoot with greater vigour. White wheat is sown occasionally, but the varieties of red are chiefly in use; they are less liable to mildew, and certainly afford a greater return. From two to two and a half bushels of seed are given to the acre. To prevent 'smut,' this is sprinkled over with stale chamber-lye immediately before it is sown, and then dusted with quicklime, which instantly dries it again, but when done freely, as it usually is, the vegetative power is destroyed if it is allowed to remain on a heap, or in sacks. The remedy appears by experience to be effectual; but too much pains cannot be bestowed in procuring good and clean seed. A custom prevails here very generally, which is little known, and rarely adopted in other parts of England, of sowing a small quantity of rye with the wheat crop on all the lighter description of soils. About a quarter of a peck to the acre is the general proportion. Much advantage evidently arises from this mixture of grain; the wheat is more plump ('bolder') than it would have been if sowed alone, and a greater quantity of *wheat* is grown upon the acre. On light soils, especially if they are in high condition, wheat, when grown alone, is apt to be mildewed; but it is very rare indeed to find this disease where a small quantity of rye has been mixed with the wheat. This preservation can only be accounted for by the shelter which the rye, a taller plant, and more erect in the straw, affords to the wheat. It has been already observed that the soil here is extremely variable; and it is not unusual to find one end of a field a strong clay, whilst the other end approximates to sand; such lighter portions are always sown with the addition of rye. No difficulty occurs in the ripening of the two grains, as they are both fit to cut at the same period. In thrashing they are kept as distinct from the clean wheat as possible, and the meslin is ground for household bread. When the wheat crop has stood pretty well, and is not very heavy on the ground, it is generally mown with a scythe, to which a bow is attached to gather the ears, and lay them straight; each mower is followed by a woman, who *lays it out* into sheaves, and also by a boy or girl, who forms the *band* to tie them up with. The corn is not cut outwards like grass, but mown inwards, *i. e.* towards the standing grain. It is always stooked before night. The average price for completing this work is from four shillings and sixpence to five shillings and sixpence per acre. When the corn is much laid, or the crop very strong, the sickle is used; the price is then from six shillings to ten shillings per acre. Much waste often occurs from the imperfect manner in which corn is cut; the work is done in a hurry, and chiefly by strangers, who come at this period of the year from the manufacturing districts in the West Riding, from Ireland and Scotland. These men feel no permanent interest in gaining the good will of the farmer, for whom it is probable they may never work again; hence their object is to make the most of the passing job. To do this a large grasp is made with the left hand, near to the top of the corn, taking in as much as it will contain in that part; the consequence of which is, that the corn must be cut high and irregularly, and many ears entirely lost; a great

quantity of straw is also left on the stubble, which would be of much greater value, if applied for litter, and converted into manure in the farm-yard. And again, to save trouble in making the bands, as much is compressed into one sheaf as it can possibly contain, and the band is consequently drawn as tight as it will bear. In this way much straggled corn is unavoidably left in the field, the average of which may be fairly stated at a bushel upon the acre. If the weather is favourable, a large and tight-bound sheaf will require to stand two days longer than a small one before it is in condition to stack. If the weather is wet, these large and tight-bound sheaves must be opened, spread to the sun and air, and then often made into smaller ones. This occasions not only much trouble, but great additional waste, and is not unfrequently the cause of a crop being sprouted and damp, that would otherwise have been well secured. In shearing by the acre, the interests of the stranger employed and the farmer are, in all respects, exactly at variance; by high shearing, large sheaves, and tight binding, the labourer will earn more money by one third than he could do by the reverse, but the farmer will suffer in a much greater proportion. The reporter has for many years past adopted another plan, for the knowledge of which he is indebted to Mr. Kirkaldie, an eminent agriculturist in the neighbourhood of Dundee. It is to let the corn to be cut by *the stook*, which is the name given here to twelve sheaves of corn when set up in the field to dry. The straw being considerrably thicker near the root than at the top, it is to the interest of the shearer to cut it low; this ensures it being cut clean and equal in height: of course he will not make the sheaves too large, because he is paid by the number; neither will he draw the bands too tight, because he is bound to make them of a certain size. Thus his interests are combined with those of his employer, and the better he performs his work, the more money he will earn per day by it. It is, however, very difficult to introduce new practices, and this mode has not been generally adopted. The farmers contend that it is more expensive, and the labourers are averse to it, because they well know that they are secured from any advantage by slighting their work. Both these objections are true; it costs more money, because work cannot be done well for the same price that it may be executed in a slovenly manner. The reporter has had many thousands of acres of corn cut in this way under his own eye; and not a single instance has occurred when any dispute has arisen between him and his men when engaged in this work. He guards against too small a sheaf by walking among his workmen with a gauge in his hand—a mere walking stick, with a very light prong, eleven inches square, screwed into the end of it; this will just stride a proper sized sheaf, thirty-three inches in circumference at the band. The labourer sees that an attempt to make his sheaves too small is detected instantly, and knows that if carried to any extent, he must make them over again,—consequently he never attempts to do it. Another, and a very great, advantage arises from the facility which this mode affords, of paying all that are employed, men, women, or children, according to the quantity of work they individually perform, and from the convenience of cutting any part of a field, and removing labourers from one field to another, without the trouble of measuring off the work they have done in it, all that is necessary being to count the stooks of twelve sheaves each. To prevent confusion by running one man's work into another, each person, or each set of labourers, for it often happens that several agree to work in common, place their first stook across, instead of down the land, as a distinguishing mark. The price of the work will vary, as it is evident that the heavier the crop the less it will cost by the stook shearing.

The average for cutting, binding, stooking, and hooding a stook of twelve sheaves will be about twopence half-penny, which, if there be sixty sheaves on the acre, will be twelve shillings and sixpence. When corn is hooded, ten sheaves are set up, leaning against each other, and the ears of these are covered by extending two other sheaves over them lengthways, the root end being a little opened, and the ears hanging downwards at each end of the stook. It is useful as a guard against birds, and some think that it greatly preserves the grain from sprouting in a wet harvest. Wheat ought never to be allowed to remain uncut until it is fully ripe. Experiments, easily made, will prove to every cultivator of it, that by permitting it to stand until the straw has lost its succulency, he gains nothing in bulk or plumpness of grain, but he loses in colour and fineness of skin; besides which he incurs the risk of shaking by a high wind, or by its being cut under the influence of a burning sun. When fully ripened by standing in the stook, no dry hour should be lost in getting it secured in the stack and well thatched.

BARLEY.

Barley is not very extensively grown at Scoreby, because though the crop is often pretty good, the sample produced is too coarse for the maltsters, and therefore does not obtain the highest price. It is found, however, to be a useful crop to follow the late eaten turnips, and those summer fallows, which either from the wetness of a season, or from negligence, or want of capital, have not been gotten clean, and in condition for a wheat crop. In this country vast numbers of pigs are fattened by cottagers and others, who do not grow grain for them; these are all purchasers of barley, and, therefore, the coarser descriptions are in much demand for this purpose, if thrashed, and taken to market early in the season. The quantity of seed sown is about two bushels per acre, which is harrowed into the ground broadcast, at any time in the month of April; but the earlier part of it is preferred. When well harrowed, the clover or grass seeds are sown, and the lightest harrows go once over them. It receives no after culture: when ripe it is mown outwards like grass, and allowed to remain in the swathe a day or two in order to dry the young clover, or grass, that has sprung up amongst it. It is then tied into sheaves and stooked, placing the greenest part which has lain next to the ground, as much as possible on the outside of the stook. No crop is so liable to heat in the stack as barley, consequently it requires considerable time to get well-dried in the field before it is carried; and if the weather permits, it is found of great service to pull the stooks over, and thus expose the bottom of them to the sun and wind, a few hours before it is forked upon the waggons. The Norfolk barley is almost the only description sown here; but it is probable that as the sample is not usually fine, the square-eared, or some other of the coarse descriptions, would be more profitable.

OATS.

Oats are chiefly grown upon the grass or clover leys, which are ploughed in the month of January or February. The strongest soils are ploughed the first, that they may be tempered by the frost. From four to six bushels per acre are sown broadcast, from the middle of March to the second week in April. The long oats called Enfields, and the Tartarian oats, are preferred to the shorter and finer kinds, as it is considered that the produce is materially greater, and in this climate they ripen sufficiently early. They

have no after culture, excepting that a few thistles are usually drawn out. Oats are cut with the scythe, being mown inwards, i. e. laid to the standing corn, and bound into sheaves in the manner before described under wheat harvest. In the York market, oats are chiefly purchased—as all grain ought to be—by weight. For these long oats, the 'shellers,' who buy the largest quantities to convert into oatmeal, will give as much per stone, as they will for the short ones. Oats are occasionally also grown after the turnip crop, in which case grass seeds are sown with them.

BEANS.

Beans are not cultivated to a great extent, but evidently with advantage, on such parts of the land as are suitable for them; they are sometimes drilled, but too often sown broadcast. The quantity of seed used is about three bushels per acre, which is put into the ground early in March. They are grown sometimes upon fallow; but more generally upon a clover or grass ley. The plan of mixing them with a few tares or late peas is occasionally adopted, and a larger crop is often obtained by it. When harvested, they are cut with a bean-hook, gathered into sheaves, and tied with straw bands, which are brought into the field for the purpose. The common horse-bean is the kind usually grown. About three years ago, the winter beans, which in many places have been highly extolled for their great produce and early ripening, were introduced from Leicestershire; but they were not valued—perhaps because they were new. Sown in October upon a clean fallow in good condition, drilled at wide intervals, and well hoed, they would undoubtedly prove a profitable crop to precede a wheat crop.

TURNIPS.

These are sown in three different ways, broadcast, drilled upon one-bout ridges, and drilled upon the level land. The first method is so decidedly inferior to the other modes, both as regards the crop itself, and the preparation for another crop, that though even yet perhaps the most general, it must gradually get out of use. If the land is tolerably clean in April, or the early part of May, and a good dunghill has been properly prepared in the winter, it is perhaps the best method to spread it very equally over the surface, plough it in immediately, and work it intimately with the soil. But if well-fermented manure has not been prepared, and from mismanagement it is necessary to use that which is longer, it can only be applied with advantage by forming one-bout ridges, at twenty-seven inches apart; putting the manure into the furrows, and then covering it by splitting the ridges. The seed in this case is drilled on the top of the ridges, as soon as they are formed over the manure. The whole bulk of the manure is thus applied to the production of the turnip crop; but when the same method is adopted with fermented dung, the young plants shoot with greater vigour, and are therefore less apt to be injured by the ravages of the fly. Of all descriptions of turnips, the ruta baga, or Swedes, are the most valuable; but they require a good soil, and a large quantity of manure, as well as very careful and effectual hoeing to bring them to perfection. They ought to be sown about the 20th of May, and can only be cultivated to advantage with the drill. They are drawn in the month of November, the roots cut off as they are taken up, plant by plant, and the bulb, with the top uncut, placed in the centre furrow upright, making one furrow contain the plants that grow upon two or three ridges, and taking care that the bottom of the plant shall touch the soil. In this way they will keep in

fine order, putting out a few small fibrous roots for several months without drawing nourishment from the land, which they most materially injure, if permitted to extend their large fangs into it through the winter. Those that remain unconsumed in February, ought to be removed again, and *placed* in the same manner upon grass land, as the land on which they have grown will then require the plough. That the Swedes are infinitely more nutritious than the other turnips, is shown very evidently by the vast improvement which fattening cattle make, when they are fed with them, after the white turnips are finished. They are equally valuable for sheep and horses. It is near the end of June before any turnips are sown. For early use the white Norfolk are considered the most profitable; they grow freely, and attain a large size. They should be succeeded by the white stone, Tancred's red, and the yellow Aberdeen; these all bear the frost, and keep better than the Norfolk turnip. A very judicious farmer and spirited agriculturist, Mr. Quarton, introduced the use of bone dust for his turnip crop a few years ago, and it has since spread considerably, and great advantage has resulted from the practice. About sixteen bushels, mixed with nearly an equal quantity of vegetable ashes, are drilled upon the acre with the seed, and in this way excellent crops are obtained.

POTATOES.

This valuable root is grown only for the use of the farms; but pretty extensively on account of the number of pigs that are fattened chiefly upon them. This is perhaps the only crop in the cultivation of which long and unfermented dung is decidedly preferable to short and well mixed manure; and perhaps this is to be attributed chiefly to its mechanical influence in keeping the soil open. When the ridges are made at first, the land ought not to be ploughed a full depth. The potatoe is then planted in the furrow, about twelve inches apart in the row, covered with the manure, which should be immediately buried by dividing the ridges to a full depth, two or three inches deeper than the potatoe was set. This attention often preserves the crop from decay in a wet season. About sixteen bushels of potatoes, cut into proper sets, are sufficient to plant an acre, and early in May is considered the best season.* As a fallow crop, potatoes are admirable; they leave the land in a state of great mellowness, and render it fit for any other crop.

MANGEL WURTZEL.

Mangel Wurtzel has not been grown largely, but enough has been sown to prove its value, and encourage the cultivation of it. The land is prepared as for turnips, and ridges are formed at the same distance. Early in May the seed is dibbled on the top of these ridges at the depth of an inch, having been previously steeped for twelve hours in rain water. The plants should be twelve inches at least apart in the rows. As each seed pod contains four or five kernels, it is necessary to look the rows over, and single the plants when the root is as thick as a crow's quill. On a light soil it grows with great rapidity, and its large succulent leaves tend much to keep down all weeds. If grown near the farm-yard, these may be gathered off with much advantage for the pigs, and if a few of the young

* Several varieties are in use for the table, and for cattle. A very good one for the latter purpose, called the Lanckman potatoe, was imported from Ghent by the Horticultural Society of London in 1821, and is extensively grown here. It is red outside, very solid, of prodigious product, and an excellent keeper.

leaves at the crown of the plant are left, the bulb does not appear at all to diminish in size. In October the plants should be drawn up, and either put into a building to protect them from severe frost, or otherwise 'pied,' that is, laid upon the ground in a dry place, on a heap about five feet wide and three feet in height, formed like the roof of a house, and covered with straw; a trench is dug round, and the soil neatly thrown over the straw, and beat down with the spade. Potatoes and carrots are also 'pied;' but all these roots are liable to decay if covered too thickly with earth. It is probable that mangel wurtzel affords a greater weight of food per acre, than any other plant in this climate; and it is doubly valuable as it retains its goodness through the trying month of April, when esculents are so much in demand for both sheep and cattle. It produces much milk when given to dairy-cows; but if used too freely, it is apt to impart a bitter flavour both to it and to the butter, though if given moderately this is not perceptible.

HAY.

Meadows.—There is a considerable tract of land situated in the valley of the Derwent, which in the winter season is flooded by that river. This is of great value, as it affords abundant crops of excellent hay, and requires no return of manure. The after eatage, ('fog,') comes in at a convenient time for the fattening cattle, or dairy-cows; though it is occasionally liable to be lost, or injured by autumnal floods. This land is seldom, and ought never to be, pastured in the spring; the grass is mown early in July, but if it was done towards the end of June, the weather for making it would be generally more favourable, and the hay of still finer quality. Nature is too little aided by the hay-makers here; the grass is usually spread soon after it is mown; but the excellent mode of preserving its sweetness by putting it into 'foot-cock,' that is drawing it up when half dry into small heaps with the rake, assisted by the foot, is but little practised. One custom is, however, deserving of note, and is peculiarly serviceable in making lowland hay. When the hay is 'made,' but its juices are not sufficiently dried to admit of its being put into a large stack, it is collected together in the cock, by a rope being put round the bottom of each, and drawing them up by horses, so that ten or twelve cocks may be formed into a 'pike,' containing about a ton of hay; or otherwise it is led from the cock in this state to the stack-yard, and placed in pikes of two or three tons each, around the site of the intended stack. When these are well formed, they cannot be materially injured by rain; and a slight fermentation commences, which prevents too much heating when put into the stack, in favourable weather, a week or ten days afterwards. Whilst this latter operation is going forward, it is found of much service to sprinkle through a sieve, about 20lb. of salt among every ton of hay. Horses, cattle, and sheep prefer it to unsalted hay, and thrive better upon it.

GRASS LEYS.

These are usually sown down with a crop of corn: 14lb. white clover, 3lb. trefoil, 2lb. rib grass, and 1lb. red clover, with a quarter of a peck of perennial ray grass, is considered the best mixture for a two or three years ley. Sometimes little more than half the quantity of these seeds are used, and in lieu of the remainder, six or eight bushels of hay seeds are sown. These leys are never mown; they ought to be pastured by sheep only the first summer, having a few young or small cattle turned into them during the autumn to eat down the rough tufts of grass; but this is not

sufficiently attended to, and in consequence they are often injured by the early treading of horses and heavy cattle.

Red clover is generally mown for the first crop, and then pastured until February, when it is ploughed up for oats. It is, however, occasionally mixed with a small portion of white clover, trefoil, and ray grass, to form a pasture for two years. Grown upon land in high condition, and near to the homestead, it is invaluable for soiling, for which purpose it ought to be mown three times in the summer. But this practice does not prevail so much as it ought to do. About 14lb. of a bright purple kidney-shaped seed, is an ample quantity for an acre. The low seedsmen are too apt to mix trefoil with their red clover; and farmers overlook it, content to purchase at a moderate price, with but little regard to the quality of the article. When clover or grass seeds are sown upon wheat, it is very material to have them well harrowed in, and this seldom injures the wheat crop.

PASTURES.

IMPROVEMENT IN PASTURE LAND.—About twelve years ago there was a small field in front of one of the farm-houses that appeared to have been long in pasture. It had been laid down in high and irregular lands; on the top of each ridge there was a little nice sweet herbage, but more than four-fifths of the land was covered with rushes and bog grasses. Mr. Wood desired to have it improved, which, taking a hint from Mr. Blakie's admirable treatise on 'Inoculating Grass Land,' was effected in the following manner :—

In the month of January, after the field had been closely pastured, the rushes were mown as near to the ground as possible, and the land was then completely underdrained with tiles. The coarse herbage was pared with the paring spade, and as much of the sod *burnt* as could be effected at that early season. What remained unburnt was drawn off and mixed with quick lime, to form a compost. The bare parts were then thinly ploughed, the ridge being set in the old deep furrow, where there was little or no soil. This was well harrowed, and the ploughing and harrowing were repeated in the same manner. By this means the original deep furrow was much raised; but in consequence of it, other deep furrows were made by the plough on each side of the lands adjoining to the good sward, which hitherto had not been disturbed. This, it has been before observed, grew upon the high ridges, and might be about four feet in width. Two yards of the end of one of these good ridges were pared, and the sward carried away. A trench, twelve inches wide, was then dug in the centre, sufficiently deep to fill up the two newly-formed furrows on each side of it. What remained was then dug, and by that operation all was made level, and no good soil had been buried. The next six feet of the good old grass were then pared off, and being well chopped into small pieces, was thrown equally over the part that had been levelled; and thus progressively the whole field was gone over. As soon as sufficient space was completed on one side of the field to admit of it, white clover seed was sown in the proportion of 14 lbs. to the acre, and a heavy roller was two or three times passed over it. The work was finished early in March. No stock was admitted until June, when the field was beautifully covered with fine young grass, which had grown and spread prodigiously from the well chopped good sward, and was intermingled with the seedling white clover. It was, however, only permitted to be very lightly eaten, and that solely by sheep, the first summer. In October the compost that had been formed with lime, and the sods that were pared, half burnt, and

carted off, was laid upon it. During the following winter, and ever since that period, it has resembled an old and fertile grass-field. The paring, laying the tiles, and spade levelling, cost, by agreement, four pounds per acre, and proved a fair job to the workmen. The tiles cost nearly three pounds per acre, and the lime one pound. This eight pounds per acre was paid by the proprietor. The tenant's labour, with the clover seed, might be rated at fifty shillings per acre, making the total expense about ten guineas. This was a great outlay, but an unsightly field, almost covered with rushes and coarse herbage, full of deep furrows, hillocks, and holes, not worth twelve shillings per acre, was, within six months, converted into a fine, fertile, and even old sward, worth in that situation, in front of an excellent and neat farm house, full thirty shillings per acre.

Grass Land Formed and Improved.—Three years ago there were five small fields in the centre of the Scoreby estate, some of which were arable, and some in inferior grass ley of seven or eight years standing. The divisions, for they could scarcely be called fences, were formed of black thorns, hazel, briars, and dead wood, occupying in many places considerable space on high banks, with deep ditches. The formation of the land was equally irregular; many of the ridges very high, and of course the furrows much sunk. The soil was light, of very inferior quality, and abounding in moisture. The proprietor took them into his own hands for the purpose of improvement in April 1829. Two of the worst of these small fields, containing together about nine acres, had been fallowed the preceding year for turnips, of which they had borne a scanty crop. These had been partly drawn off for cattle, and partly eaten upon the ground, which poached exceedingly by the treading. The first operation was a thin ploughing, and slight harrowing as soon as sufficiently dry. The ridges and furrows were then ploughed outwards as deep as possible, by going two or three times round each. The furrows were then sunk to the proper depth by the spade for underdraining, and tiles were laid in them. These were covered with the light soil that had been thrown out with the spade; and further, by a trench being dug two feet wide and nine inches deep, from the open furrows made by the plough on the ridges of the lands. By this means the worst soil was taken to raise the furrows, and the ridges were not robbed of good soil. The plough was then again employed to close in the ridges and furrows by returning the soil to its former place: these were now brought to a level, whilst the middle of the lands remained, if anything, the highest. One or two cross ploughings, with good harrowing, made all perfectly smooth, and the land was in a state to sow. In the mean time the old hedges had been stubbed up, the thorns and briars bedded close in the deep unsightly ditches, and the banks levelled over them. The least thriving timber trees, with which these old fences abounded, were taken down, leaving the finest to stand in groups, or singly, as circumstances directed. Early in the month of June, one of these fields, then ready, was sown with buck-wheat, one bushel to the acre, with 14lbs. white clover, 3lbs. trefoil, 1lb. red clover, and four bushels of the best hay seeds. The buck-wheat, which perhaps exhausts the land less than any other corn crop, and when sown thin affords a most beneficial shade to the young grasses, was harvested in September. The other field was not in readiness to sow until the month of July, when it was sown with a quarter of a peck of rape seed and grass seeds in the proportion already mentioned. The rape was not luxuriant, but it was slightly eaten by sheep at the close of autumn. No stock was then admitted until May, and through the summer it was pastured only

by sheep. In the autumn of 1830 the whole had a dressing of compost, formed of clay hauks well mixed with lime, and afterwards with an addition of manure and bone dust. This compost was well brushed in. The other three fields were successively treated in the same manner. The whole plot, upwards of twenty-five acres, is now dry and level, very promising to make a piece of good grass land of treble its former value. The trees which grew in the fences afford shade and shelter to the stock, and give much beauty to its general appearance. No land pays better for improving than grass lands, and yet no land is so generally neglected. The quantity of permanent pasture has been greatly lessened of late years, *much to the injury of proprietors, and without lasting benefit to the tenant.*

The thistle, in all its varieties, is a most noxious weed in the grass land, and too little pains is taken to get rid of it. In the month of August or September the farmers look over their pastures with a scythe, and cut a few down; but this is far too late to do the essential service. The greatest part of their abundant seed has long before been scattered by the wind, and an ample crop has been sown for succeeding years. There is also a general want of care to destroy those which grow numerously in the hedge rows, and on the margin of corn fields. An attentive farmer will not allow the month of June to pass over without cutting down all the thistles on his farm, whether growing in the pastures or adjoining to his arable lands, and he will repeat the operation in August. This, when persevered in for a few years, is attended with very little expense, and much good herbage is gained by it. It is an excellent plan, and adopted by some cultivators at Scoreby, to draw up the thistle in moist seasons by the root. This is readily done by a simple implement, a sort of pincers, which is generally used in the corn fields for this purpose, called here 'Neps.' Every farmer should not only know, but remember, that the thistle is a biennial plant, and therefore if the seed be prevented from ripening, the crop will soon cease to be produced.

It is a good practice to use the moulding sledge, brushed with thorns, upon the pastures, as well as upon the meadow land, in the spring. In fattening pastures it will be found serviceable to mow down all the rough and coarse grass which the cattle have neglected; make into hay, and carry it to the stack-yard. For this purpose the pasture should be cleared of stock for a week, which materially sweetens it. The cattle will bite freely of the young grass in these coarser parts as it springs up again, and thrive the better for it; and the hay thus obtained, though of inferior quality, serves to top up the stacks of meadow hay, and will be greedily eaten by lean stock in the winter, especially if it be freely salted. This is regularly adopted by the extensive graziers in the Lincolnshire marshes. It is considered bad management not to have a pasture occasionally clear of stock; sheep in particular require a frequent change. If, therefore, a farmer has forty sheep to fatten in two fields of twelve acres each, he finds it much more eligible to keep them a week in one of the fields, and the next week in the other, than to divide them into two flocks, and keep twenty in each. Rushes cannot be destroyed without draining, but they are materially prevented from increasing by being close mown in the winter; their open tubes are injured by the admission of rain and frost, and they then, like other plants, pruned at an improper period, shoot with less vigour; besides which all increase by seed is prevented. Sound grass land, which will bear winter treading, is much improved by it; but when the land is wet and liable to poach, the cattle should be removed from it in November, when all the grips and water courses should be

well cleaned out, and no stock should be admitted until vegetation is renewed in the spring. These grippings make a valuable dressing when intimately mixed with lime, and returned upon the land, after lying a year to decompose.

LIVE STOCK.

The city of York has long been celebrated for its fairs and markets for stock: these were formerly held in crowded and narrow streets within its walls. A few years ago, the corporation purchased an extensive plot of ground immediately behind the city walls, and very near to the streets where the cattle and sheep were formerly sold. This ground was fitted up with pens and folds of various sizes, and converted into one of the best laid out markets in the kingdom. Here a fair is held once a fortnight, well supplied with both fat and lean stock; the latter of which, especially during the spring and autumn, is exhibited in prodigious quantities. Both sheep and beasts are brought from all parts of the north of England, from Scotland, and from Ireland, by jobbers who attend more distant fairs. This is the principal cause why such diversities of breed are found, not only at Scoreby, but generally in this division of Yorkshire. It is quite common to see upon one farm, Leicester, Cheviot, and Moorland sheep; and Durham, Scotch, and Irish cattle.

HORSES.

Many very good ones are bred here, both for carriages, the road, and draught. The best of these are usually sold at the great mart held at Howden, about the close of September, when they are two years and a half old. A considerable loss, however, certainly occurs from the farmers being tempted to sell their best fillies, generally to go abroad; thus keeping the inferior ones for farm work, and then breeding from them. If as much pains were taken to reserve good mares, as sound judgment would direct, the breeding of horses would be found more profitable than it now is. Few of the heavy black horses are seen here; those used for the plough are of a lighter and more active description.

CATTLE.

Horned Cattle.—If this district can be said to have a breed, it is the short-horned, or Durham, which are too universally known to require description. Many good cows of this kind are kept at Scoreby for the dairy, and of course a number of calves are reared beyond what are fattened for the butchers. The calf is taken from the cow to the calf-house as soon as it is dropped; there it is well littered with clean straw, and rubbed dry. A little of the dam's milk, 'hislings,' is then given to it with a spoon. It is fed with this twice a day, and soon learns to drink it from the pail, whilst warm from the cow. The calf is often sold to the butcher at a month's age; but the veal is considerably better when the calf is a fortnight older, which it usually is when veal is equal in demand to butter. Fastidious people will not purchase veal unless it appears very white, and to procure this unnatural colour, a week's fattening is lost; for at that period, before the calf is killed, it is bled as much as it will bear, that is, as long as it is able to stand: in four days after, this operation is repeated with equal severity; and again, the butcher, as soon as he has got the calf home, usually applies the fleam, twelve hours before he gives the finishing stroke with the knife. If the whiteness was less regarded, there

is no doubt but the meat would be fatter, more palatable, and more nutritious. Calves intended for 'holding,' are seldom allowed the milk of their dams more than three or four days; it is then mixed with linseed porridge, or skimmed milk, thickened with wheat flour, or oatmeal; and when about six weeks old, a little sweet hay is hung up in a string before them, which they soon learn to eat. The three first months in the year are decidedly the best for holding calves, and but few are reared after that period. They then get the advantage of the spring grass; though they are still fed with the pail, unless calved very early in the year. The following winter they usually run in a grass field, where they are allowed turnips and hay. The second winter these young beasts are put into the straw-fold; but there they have, especially towards the spring, a little hay, and a few refuse turnips. Indeed, few cattle are kept at Scoreby solely upon straw; though it is too often forgotten, that two beasts well kept will attain a greater weight, than three would do if kept indifferently to the same age. The reporter has bred a great number of the short-horned, or Durham cattle, the steers of which have been sold fat to the butchers, when two and a half years of age, averaging from sixty to seventy stones weight, 14lb. to the stone. Though it has been observed that here, and in the neighbourhood, there were large quantities of Scotch and Irish cattle fattened, yet none but the short-horned are bred from, or at least few of the mixed breed are retained for a holding stock. Oxen are not so much used for the draught as they were some years ago, still several are kept for that purpose, and are found highly valuable for heavy work, and especially over soft ground. It is not the custom to shoe them, or to use them much upon the hard roads. It is difficult to account for their decline, as moderate work does not appear to have any effect in checking their growth, which from two to five years old will pay for their keep, and the work got out of them is a bonus. When arrived at this age, they are turned to grass, kept in the fog in the autumn, and fattened up with turnips very readily in the winter. Eighty stone of prime beef is worth £24 more than a dead horse, which goes to the dog kennel. The steers that are not drawn, are usually sold at York to the dealers at two years of age, from whence they go to the rich marshes in Lincolnshire, or the fine grazing lands in Leicestershire to be fattened.

Cows are kept largely at Scoreby, and a considerable quantity of butter is made, both for the purpose of present use, and also to put up in firkins. The dairy seems to be considered the most profitable branch of farming, and therefore much attention is paid to it. In the summer the cows are indulged with the best old grass land for pastures; and in the winter a full quantity of hay and turnips are allotted to them in the cow-house. To obviate the unpleasant flavour, which the latter gives both to the milk and to the butter, a pint of boiling water is added to every two gallons of milk, when it is brought into the dairy; and a quarter of an ounce of saltpetre is put into the cream pot for every two gallons of cream. Care is taken to apply the saltpetre a day or two before the cows begin to feed upon turnips, and it is considered necessary always to leave a little of the old cream, to begin a stock for the next churning. Carrots are accounted the best food for cows in the winter season, and the butter made from them is the richest in colour, and the finest in flavour; but though there is a considerable quantity of land well adapted for the growth of them, they are not usually cultivated.

A small quantity of cheese is made, but chiefly from old milk, and, therefore, of an inferior description.

SHEEP.

In this species of stock, we find the same diversity, which was before remarked of cattle. Mr. Quarton keeps some very good ewes of the Leicester, or Wold breed, for the purpose of rearing holding stock. He puts his lambs, called here 'hogs,' upon turnips during the winter, and gets them fat before the close of the summer, when they weigh about 20lb. per quarter. Early in October vast numbers of drafted ewes of the Cheviot breed are exposed for sale at York, where they are brought from the southern counties of Scotland; though these are generally either old, or of a very inferior description; many are purchased at from twelve to eighteen shillings per head, for the purpose of breeding lambs for the butcher. They are a hardy race of sheep, excellent milkers, and not very difficult to fatten. The lambs produced from them by a Wold ram fatten very readily, and are purchased by the butchers, who attend the York fairs from the populous parts of the West Riding. As soon as the lambs are weaned, and the ewes have got rid of their milk, they also are fattened; and, when properly managed, both ewes and lambs are cleared off in October, to make room for a new flock of the same description. The fleeces of these sheep are very light, not averaging 3lb., and the ewes rarely weigh more than 12 or 13lb. per quarter. For several years the reporter was in the habit of purchasing Cheviot Gimmer hogs, of the best description he could find, at Appleby fair in Westmorland, on the 10th of June, where large quantities are brought from Dumfrieshire and Sutherland. These were shorn as soon as possible after they were brought home, well kept, and had early lambs from Leicester rams the following spring, which were sold fat, and the ewes also were sold fat in September. These improved Cheviots were beautiful sheep, and were found much more profitable than such as are usually sold at York. Their fleeces averaged from 4 to 5lb., and the ewes weighed about 18lb. per quarter. The Cheviots are not however so quiet in their pasture as the Wold sheep are, and much care is requisite in fencing against them. In this closely wooded country, the fly proves a great enemy to sheep, and it is often necessary to cover the heads of a whole flock with caps to prevent their injuring them. Salt is used here occasionally, and if it were given more regularly, and the sheep were induced by having it mixed with their food, to take it in larger quantities, there is little doubt but it would prevent the appearance of the rot, which disease occasionally makes great ravages in all low situated grounds They are regularly trained to eat it, when first mixed in small proportions with oats, and soon become extremely partial to it. During the autumnal and winter months, a salt-trough, and a sheep-rack for hay, should be found with every flock, whether feeding upon grass or upon turnips.

PIGS.

Pigs are bred and kept in considerable numbers, but sufficient attention is not paid to the breed. It was attempted to be improved a few years ago, by procuring a very valuable kind from Adam Blandy, Esq., of Kingston House in Berkshire. These were fine in bone and hair, of considerable size, and great propensity to fatten; but unfortunately for their estimation, in one particular they resembled a breed that formerly prevailed much in this district, and which were bad thrivers—they had a long snout, and this long snout prejudiced the farmers against them. They are now extinct at Scoreby, and none nearly so good are left behind them. There have, however, been some good boars introduced at different periods into

the neighbourhood by Mr. Claridge, and, generally speaking, the pigs are not very bad. Beilby Thompson, Esq. of Escricke, M.P., whose extensive estates adjoin Scoreby, has lately procured some very fine Neapolitan pigs; and if his tenants avail themselves of the cross, there is no doubt but a considerable improvement will take place in consequence of it. When the rapidity of breed, and the amazing production of pigs is considered, it will be found an object of no small consequence to procure the best sorts. If attended to, they are in themselves a profitable stock, and the benefit they do, on an arable farm especially, by converting a large quantity of straw into good manure, ought never to be lost sight of. The short space of time in which large quantities may be reared, renders them exceedingly fluctuating in value; but taking one period with another, they pay well for consuming, not only the refuse of the farm, which would otherwise be wasted, but for crops cultivated solely for their use. Red clover cut very young, answers well for this purpose; beans perhaps still better. When these are cultivated for pigs, they should be sown st different times, at the beginning of February, March, April, and May. The cutting may commence soon after the pods are formed; in this state they will feed greedily upon the stalk, and they will continue to do so until the beans are nearly ripe. If grown on a light soil, it is well to mix them with tares, or late peas; and for this purpose a light soil will answer fully as well as that which is termed bean-land, as it will grow more straw, and it is the stem and leaf that is wanted, more than the swad or grain. These will be followed by potatoes, cabbages, carrots, mangel wurtzel, and Swedish turnips. To carry on this branch to the greatest advantage, an apparatus for steaming the roots is requisite. If the potatoes are merely boiled, a waste of time is occasioned, and the potatoe water, generally considered to be injurious, is unavoidably mixed with the food. A better and very simple plan might be adopted, by having two casks with grated bottoms, and a tight fitting lid. Set one of these over a small copper, and stop the steam as closely as possible with a wet cloth, as soon as the potatoes are boiled lift it off, and put on the other cask, which should be ready filled with potatoes washed very clean. Whatever roots are boiled for pigs, they ought to be well beaten with a large wooden pestle or rammer whilst they are hot; it is then soon done, though it is a troublesome operation after they have become cold again. Potatoes and cabbages boil in considerably less time than carrots, Swedish turnips, and mangel wurtzel, and are perhaps more improved by cookery. When the pigs are put up to fatten, which usually commences as soon as they have glesned the stubble-fields, they have for the first fortnight boiled potatoes only, then a little barley-meal is added, gradually increasing the quantity of meal as they approach to being fat, and at last the potatoes are altogether discontinued. Occasionally, bean-meal is used instead of barley, and this is said to make the firmest and best-flavoured bacon. In all farm-houses in the East Riding of Yorkshire, a very large quantity of bacon is eaten in proportion to other animal food, and the agricultural labourer subsists chiefly upon it, and potatoes.

LABOUR.

All the farming work used to be performed by young men, yearly servants, who lived in their master's house, and were at his call at all hours. A very material change has taken place since the peace. A few years before that period, cultivation was improved to a great extent. The prospect of profit afforded by the high, and almost progressively increasing price of produce, had induced men of education and capital to

embark extensively in farming; and they spared neither trouble nor expense to obtain large crops of grain, and to bring to market the greatest quantity of animal food. So vast an increase of labour was consequently requisite, that the agricultural population was unequal to supply the demand. Now the case is far different. Capital is exhausted, the large farms, occupied by the class described, have been given up, and being totally out of request, have been necessarily divided into small ones. Less labour has been required, and numbers, who, during the war, found profitable employment in a variety of departments from home, have since the cessation of it been compelled to seek for work in their own parish. This has decreased the call for the young men who used to be hired as yearly farm-servants; they have found it difficult to procure employment, because the farmers were obliged to find work for the married men who had families, which otherwise must have been supported in idleness. It seems strange to assert that the difficulty which young single men experience to provide the requisites of life for themselves, should have tended to induce them to marry, and thus to add to their difficulties the burden of a family. Yet it is well known that this is the fact. Marriage is contracted at an early age, and stout able-bodied men, under twenty-five years of age, do not hesitate to apply to the overseer of the poor for employment. Thus is the evil perpetually increasing. At Scoreby, as in almost every parish, there are a greater number of agricultural labourers than employment can be found for. Consequently the work is now done by these, and very few young men are hired for a year. The compulsion that the farmer feels himself under to find work for the married labourers who have a settlement in the township, has a great tendency to destroy that good feeling which ought to exist between master and man, and without which it is in vain to expect that the work will be done in a satisfactory manner. This is perhaps the cause why much work is performed by the day, that might, with greater advantage to both parties, be executed by measure. The labourer knows that his family will be supported, however small his exertions, and he therefore too frequently prefers trifling wages earned by moderate work. That noble stimulus to better his condition, which used to be so general, is now but rarely found. Few labourers can depend upon constant employment; and if a man, by cautious saving and good management, has got so forward as to purchase a cow, a couple of pigs, and perhaps to have a few pounds in a saving bank, he is too often rejected as a winter labourer, to make room for one who would otherwise be an immediate burden upon the parish. It is this class of men—those whom we should be most averse to lose—who emigrate chiefly to America. Our most intelligent and enterprising farmers, and our most skilful and industrious labourers, finding all their efforts unavailing to gain a maintenance in their native land, leave it, to seek in another country that return for capital, and that reward for industry, which the present condition of England cannot afford them. This scarcity of work, as compared with the supply of labour, is an incalculable evil, and operates much more extensively in destroying an honest feeling of independence than most men are aware of. The capital of tenants in general, in common with that of the rest of the community, has been so much reduced of late years, that they are really unable, speaking of them as a body, to employ the number of hands that are requisite for high and profitable management. If a ditch can remain unscoured, or a fence uncut, without very great detriment at the present moment, it is passed over to another year. The great object is to save every shilling that he can in labour, and to have what must be done executed by those to whose support he must contribute either in the shape

of wages or poor rates. The labourers at Scoreby have, however, suffered less than in many parts of this district, having been constantly employed by the proprietor in making improvements upon the estate. In this the tenants have also had their advantage, and it would have operated to a greater extent, if the estate had not been coupled in the maintenance of its poor, with another division, where the same system was not pursued. These labourers have had liberal wages, making in the winter season not less than from nine to twelve shillings a week, and often more by task work. A short time back there was not one cottage upon this estate; consequently, all the labourers had to come from a considerable distance every morning, and to travel over the same space at night. The loss and hardship of this was divided between the employer and the employed; both suffered from it: and from this circumstance less work was furnished for their wives and children. To a great extent this evil still exists, though four comfortable cottages have been built. These have ample garden ground to grow produce for the inhabitants and their pigs, and two of these cottagers possess cows. It is evident that the gardens are of considerable service, and they afford useful and profitable employment to their wives and children. They contribute much to health and comfort, and prevent the growth of idle habits when unemployed by the farmer.

WOODLANDS AND PLANTATIONS.

It was before observed, that the woodlands extended to about two hundred acres. Of these one hundred and eighty acres are chiefly oak, advancing to valuable timber. The rapid improvement which has been made in the growth and vigour of these trees for a few years past, is an evident proof of the advantage to be derived from prudent and moderate, but progressive thinning, and from effectual draining.

Plantations to the extent of about twenty acres have been lately made upon this estate in three different modes, and in nearly equal quantities. In the first instance the lands were planted in the old and general method, simply by digging holes to receive the roots of the young plants: these trees, which were of a mixed description, grow and thrive in the usual manner. A few years afterwards a second plantation was made of the same kind of mixed trees, of which larch and oak formed the largest portion. This land was of very inferior description; a bad grass lay, full of rushes, and dwarfish plants of heath. This was ploughed to a considerable depth by one plough turning up a large furrow, and a second plough following in the same furrow to throw the subsoil over it. A complete summer fallow ended the preparation. The ground was planted in the spring following, and for four years it was kept tolerably clean by the spittle and hand hoe. These plants throve with very great luxuriance, sufficient to compensate the expenses that had been incurred in the preparation of the land, which amounted to fifty-two shillings per acre; add one year's rent and taxes, eight shillings, making three pounds per acre. The third plantation was made on considerably better soil, which had also been a grass lay for seven or eight years. This was dug with the spade to the depth of more than twenty-four inches, by taking two spits in depth, and casting the grass to the bottom of the trench. The cost of this work was considerable, exceeding seven pounds per acre; but there was no loss of time, as the land was planted as soon as it was dug. This plantation has been kept perfectly clean with the spittle or Dutch hoe. These plants have grown with a degree of vigour that far surpasses the fallowed plan-

tation, and which can scarcely be exceeded. The plants are mixed, but chiefly oak and Spanish chestnut.

Altogether the woods and plantations afford ample proof, that a great deal of labour may be bestowed upon this description of property, as much to the advantage of the proprietor, as to those poor families who earn their bread by the employment thus obtained.

GENERAL OBSERVATIONS.

Every attentive observer of rural affairs must see that agriculture is on the decline. Farmers do not evince that energy which regulated their conduct and the management of their land a few years ago. The fallows are not made with the same attention to the destruction of weeds, nor enriched by artificial means, and the supply of manures from distant places. The drains are not so well scoured out, nor the fences kept with the same neatness that they were wont to be. There is a greater desire to crop the land in such a manner as is likely to bring early profit without regard to future consequences.

There is little emulation among farmers to procure good stocks of cattle for breeding; they have ceased to give such prices as formerly stimulated men of education and capital to devote their talents to the exclusive improvement of live stock; and they are perhaps less kind and liberal to the labourers and servants under their employ.

Yet for all this no blame can morally attach to the farmer; it springs solely from one cause; it is forced upon him by the decline of his capital. Year after year he has been losing by his avocations; the little stores that were in various channels laid by for the benefit of his family, have been drawn upon and exhausted. He is compelled by his situation to adopt a narrow-minded policy, that is not directed by his judgment, nor approved by his heart.

Very great reductions have been made by landlords in their rents, and a vast weight of direct taxation has been removed; still it is evident that farmers have borne, and continue to bear, at least their proportion of that distress which unhappily pervades the whole country. A long and expensive foreign war, accompanied by a most extravagant expenditure of the public money at home, was tolerated only because the evils of it were concealed from the general view by a fictitious wealth, and thereby a general delusion created. This fictitious wealth is withdrawn, and we are now presented with a real view of our condition; and slow and gradual must of necessity be the approach to anything resembling prosperity to the landed interest; and a long period must elapse before the capital of farmers can be restored. A considerable reduction in direct taxation has been made; but the poor's rate has progressively increased in agricultural districts; other taxes are yet heavy; and a new species of levy has arisen, under the term of the 'Constable's Assessment,' i. e. money raised for the county rates. This used to be of small extent, but is now enlarged into such serious importance, as to call loudly upon the magistrates, and also upon the representatives of the people, to look into the mode in which this money is expended. It is probable that the receipts of many of the chief constables, arising from fees, might thereby be considerably diminished. It will be remembered too, that the roads are almost exclusively maintained by the agriculturists; to say nothing of that positive bane, if not prohibition to good farming—tithe. Happily this district in general is tolerably free from it.

These taxes, great in themselves, are very much increased by the management, or rather mismanagement of them. This year A. is the overseer of the poor; B. is the surveyor of the high roads; C. the constable; D. the churchwarden; and E. the collector of assessed taxes. Their offices are held for one year, and then terminate. For a few years, if the township be large, they are perhaps exempt from office, and then in rotation they take it again; but not in the same order. He who was the overseer of the poor, is now the surveyor of roads, &c. &c.; yet nothing can be more obvious, than that a man may have learnt his trade as a tailor, and yet make a very indifferent shoemaker. However good the natural abilities of a man may be, and however desirous of doing his duty, yet he is not able to execute the duties of any office in the best manner, to which his time and attention have not been previously directed. It is exceedingly inconvenient to farmers generally to be called into these offices, and they are very irksome to them. They take them from their own affairs, and require an accuracy in accounts, and a time for management, which they are unable to devote to them. Besides this, a tenant has often too short, and too uncertain an interest in the parish, to induce him to act for the general benefit. 'Why should I promote an expense in the repair of this road, which I myself must contribute to? If deferred until next year, it will fall upon my successor, for I shall have left the parish.' Many a surveyor of the roads, and many an overseer of the poor, has reasoned with himself in this way; and many have been the indictments of roads, and many the paupers saddled upon a parish, in consequence of such reasoning. There is little doubt but great advantage would arise to the public, as well as to individuals, if the present system of making farmers hold these offices was entirely abolished. *In lieu of it an overseer of the poor might be appointed for one, two, or three small townships, with a suitable salary. In like manner surveyors of the roads might be appointed, who would manage them infinitely better, and much more economically than A. B. and C.* This will never be done generally, unless enforced by parliamentary authority; though in some parishes, where it has been adopted, great benefit has resulted from the practice.

Another serious evil has arisen, especially since the termination of the war, from the desertion of country gentlemen. This is a real injury to their estates, their tenantry, and to the labouring class of villagers. The eye of the resident proprietor is usually directed to the improvement of his estate. His tenants desiring his countenance, and generally respecting his character, are willing, as far as it lies in their power, to promote his views. The connexion between them is not a mere money transaction, it is far more binding than a ledger account of pounds, shillings, and pence. On all well-regulated estates, the landlord is looked up to with a patriarchal feeling, which does not exist in the same degree in any other relation in life. He possesses an influence, that, if well directed, as it usually is, tends to improve the character and conduct of those around him. The labourers are benefited by his employ, good habits are encouraged by him, and bad ones are checked by his observation. Their wives and their children are often more immediately placed under the care and inspection of the revered partner of his mansion. In sickness she kindly directs that they shall be supplied with medical aid, food suitable to their condition, and attentions far beyond what they could procure for themselves, or the most liberal overseer would be justified in allowing. The village schools are promoted by her, and through the aid of her bounty, the children are benefited by the inestimable advantages of education. It is also of prodigious advantage, that the wealth produced in any district should, as far as may be con-

sistent with the refinements of society, be again expended in it, and returned to it. The vicinity of Scoreby affords instances of change in this respect, which, in a greater or less degree, is probably to be found everywhere. We have those doing all the good in its fullest extent that has been described, where, but a few years ago, little or no advantage was derived from residence.

MEANS OF IMPROVEMENT.

In the exhausted state of capital, under which the tenants are now generally suffering, and the privations which even their landlords are in many cases obliged, from a greatly reduced, and not very well paid rental, to share with them, it is difficult to point out the means by which great improvements in agriculture can be effected. There is, however, no doubt but farmers have yet much to learn, that might materially contribute to their advantage. Old prejudices are not easily eradicated, nor new practices introduced, among a class of men who seldom go out of their own neighbourhood, who associate only with those who are placed immediately around them, and who are too little in the habit of reading what is published on the practice of more distant counties. Many of the works on agricultural subjects are too theoretical to be of great use; and the practical parts are not sufficiently and plainly detailed. 'The Reports,' drawn up under the direction of the Board of Agriculture are indeed a treasure; but they are too expensive to obtain great circulation among that body of men for whose use they were chiefly intended. Perhaps much might be effected, in time, by the formation of farmer's libraries, if the establishments were promoted by the owners of the soil. The desire to obtain knowledge is generally proportionate to the means of it, and progressively increases as it is acquired.

From even the worst cultivated districts in England, the best may yet learn something. The operations of farmers are more various and more extensive than are to be found in any other occupation. They do not admit of those advantages by a division of labour that are found in manufacturing concerns, and hence the work cannot be so well understood, nor so perfectly executed.

UNDER DRAINING WITH TILES,

twenty years ago, had scarcely been heard of here; but it has gained ground rapidly, and the most extensive improvements have been effected by it. It has been much used at Scoreby, and with very great benefit. The tile is from thirteen to fourteen inches in length, something more than four inches in width at the bottom, and four inches and a half in height. The arched channel, to admit the passage of water, is three inches wide at the bottom, and four inches deep. These are the tiles principally required; and the price of them at the tile-yards is from thirty-five to forty-two shillings per thousand. What is now the highest price, was the lowest sum which in this district they could be purchased for. Other tiles are made for the main underdrains of larger dimensions, which are charged from fifty to fifty-five shillings per thousand; but these are seldom requisite, as it is always desirable if possible to run each drain distinct and singly to an open drain, in which case, if a stoppage should occur, the place where it has happened is more readily found, and the injury repaired. Wet land, if the subsoil is moderately open, will be rendered perfectly sound and dry, by drains laid twelve yards apart. According to this calculation, 1000 tiles will be nearly sufficient to drain an acre of land. At 12 yards apart there

will be 400 yards, or 57 roods of drain on each acre; the expense of which in round numbers may be calculated thus:

	£.	s.	d.
1000 tiles, at the maker's yard	1	18	0
Carting, say four miles	0	7	0
Digging 57 roods of drain 30 inches deep, laying the tiles, covering in the soil, and treading it down, at 4d. per rood	0	19	0
Average cost per acre	3	4	0

At Scoreby, which is well situated for land and water carriage, the expenses have been somewhat less than the above, scarcely amounting to three pounds per acre. The tiles have been invariably furnished by the proprietor, and the carting and labour by the occupier. In some places where the land is particularly springy, and inclined to bog, it is necessary to lay down flat tiles as a foundation, to prevent the drain tile from sinking; but this is often found needless, and there are usually a few broken tiles ready to be applied to any suspicious parts. Where the flat tiles are used, the great enemy to underdrainers, the mole, is effectually prevented from doing mischief. It was formerly a very general, though a very bad practice, to raise the lands, by ploughing them into very high ridges; and where these yet exist, as they very commonly do, farmers are anxious to lessen the expense of cutting, by placing the drain along the furrows. But by so doing the best line, and the most suitable distance for the drains, is often sacrificed. Without a fall for the water the drains are useless, but too rapid a descent is injurious to the permanency of the drain. As soon as the tiles are covered in, a broad wheeled cart is driven along them, keeping one wheel just over the centre of the drain, which tends materially to render the earth firm, and prevent the partial sinking of cattle. The greatest improvements have been made by underdraining, not only by enabling the land itself to bear much larger and more certain crops of grain, and by rendering the herbage, when in grass, both greater in quantity and far more salubrious in quality, but also, in many instances, by promoting the fertility of other lands in the farm. Thus, at Scoreby, it has made turnip land where turnips could not be grown before with any prospect of advantage, near to the farm buildings, thereby enabling the occupier to draw large quantities to the cattle houses, and thus doubling in value the whole of the manure arising from the straw. It is not too much to assert, that in particular fields which are favourably situated for underdraining, and near to a farm stead, by the expenditure of three pounds in underdraining, the land may be permanently improved to the extent of ten shillings per acre.

There have, however, been considerable sums expended in underdraining, very little to the benefit of either the proprietor or the occupier, for it is a work that requires judgment in the plan and attention in the execution. Sometimes the drains are cut so shallow, as not to secure the tiles from being broken by treading on the surface. Sometimes the workmen, not being well looked after, will cut to a regular depth from the top, and entirely lose a fall for the water, by not sinking the drain sufficiently through a little rise in the land; and at other times the whole advantage is lost by neglect in not scouring out the open ditches, into which the drains were intended to empty themselves. An attempt to drain a very retentive soil is always in vain; it never repays the money expended upon it.

Where from the spongy nature of the soil, or from springs of water issuing through a thin stratum of clay, large open drains are apt to slip

in, and cove from the bottom of the banks, and thus to require perpetual cleaning to prevent the obstruction of the water, a cure may often be effected by laying one of these tile drains on each side of and in a parallel line with the main drain, at a distance of four or five yards from it. But in no situation can these drains be used with so much advantage as on the high roads, on all wet and spongy soils, and especially where they are formed on the side of a hill. The saving in repairs will be found prodigious, and the benefit proportionally great.

GREEN CROPS FOR THE FARM-YARD.

SOILING.—The number of years which the reporter has practised this upon a large scale, enables him to speak with much confidence of its merits. The principal crops for this purpose are red clover and winter and spring tares. These should be grown on land in very high condition, and as near as possible to the farm-yard. A very small quantity, say two quarts, of rye should be added to nearly two bushels of winter tares for the seed for an acre, which tends materially to support the plants, and preserve them from decaying on the ground, which they are apt to do at an early period in the summer, when the crop is very luxuriant. These should be sown in September or October.

In the same manner a few beans should be mixed with the spring tares, which are sown in the month of March. The first cutting of the winter tares will usually commence about the 15th of May; and as soon as it is possible to mow them, it should be done very freely, as the clover and spring tares will be abundant by the 1st of June. There is no doubt but one acre of these crops, carted green to the farm-yard, and given to horses in a cool stable, will go further than four acres of the best grass land. From the middle of May to the end of September it is bad management to allow draught horses to be turned out to pasture. They get their food in a much shorter time, and have consequently a longer period for rest. It is but too usual to keep horses all the day at the plough; and by turning them into a scanty pasture, to compel them to work all the night for their food. If horses are well kept, there is also a danger in turning them out to grass when shod, as they very frequently strike each other. This is avoided by soiling; and the trouble, when executed in a regular system, scarcely exceeds that of turning them out to grass, and getting them up again. Though this mode is decidedly the most advantageous in the keeping of draught horses and draught oxen, yet it is applicable to all horses, and to all descriptions of horned cattle. On an arable farm, where straw is plentiful, the quantity of manure made in summer may be as large as that which has been made in the winter, and the quality of both will be much improved by thus making the straw go to its utmost extent. By this husbandry a full stock of pigs may be kept to considerable benefit. Care should be taken never to allow the crops to be too long uncut, as it would occasion a waste of the leaves, and render the stalk less palatable and nutritious to the cattle, beside which it greatly injures the following crop. It is difficult so to proportion the stock to the produce, as to have at all times plenty of green food, and at no time too much. The latter is of the least moment, because, if requisite, more stock may be generally brought from the pasture, and if not, the overplus may always be cut for winter fodder. The clover or tares should be mown once a day, when the dew is dry, otherwise the food will spoil by heating. A field, which contained about fourteen acres of land, was divided by the reporter into seven parts, for the purpose of soiling in the following course:

barley, red clover, mangel wurtzel, winter tares, Swedish turnips, spring tares, turnips. This was carried on for some years, affording each year six acres of summer food and six acres of winter food for cattle in the farm yard. By the practice of soiling, an arable farm may be made to support as much live stock as a grazing one.

MANURE AND COMPOSTS.

Though every one knows how much the crops depend upon the quantity of manure which is bestowed upon them, yet farmers in general are not sufficiently attentive to the production and good management of it. As soon as the farm-yard is emptied, a quantity of light soil, which may be always procured from banks, or road scrapings, should be brought into it. All inequalities on the surface should then be levelled, and the yard formed into the shape of a very shallow saucer, being the deepest in the centre. This should be immediately covered with litter, and be the general receptacle for potatoe tops, and waste of every kind that is convertible into manure. The value of the manure will greatly depend upon the quantity of live stock that is kept in it and in the cattle-houses around it, and especially upon their being well supplied both summer and winter with green food and bulbous roots. The manure from the doors of these houses should be occasionally thrown to the middle of the yard, that all may be duly mixed. When carted out it should be placed upon a layer of earth, and the carts ought not to press it down by being driven over it, as it greatly retards the progress of the composition. The manure-hill should be made in a compact form, and banked up square, to exclude as much as possible both sun and air. It should then be slightly covered over with another layer of earth on the top. By this means none of its virtues are lost, and the top and bottom soil will mix with and nearly equal in value the rest of the heap. It is too often the practice to lay manure on the sides of roads, and on sloping ground where its juices are perpetually wasting; this is unsightly and unprofitable: it is best laid upon level land in the field where it is intended to be used. When it is spread, much care should be bestowed in dividing it minutely, and shaking it evenly over the whole surface of the ground; and it is absolutely necessary that the plough should instantly follow the dung carts on arable land.

Bones.—These were formerly of no importance as a manure. A few good farmers indeed collected them thirty years ago in this district, and by various devices had them broken into as small pieces as their machinery and patience allowed. They were then spread on fallow lands out of a cart with a shovel, at the rate of from two to four cart-loads per acre, and they were considered a very efficacious and durable manure, but were by no means in common use. About twenty years since the practice of crushing them between powerful fluted iron rollers was introduced; the machinery was then rapidly improved, and vast quantities were imported from the continent to Hull, and sold into the country. They have proved valuable for almost all crops, and on almost every description of soil; but they have been chiefly applied to the production of turnips. They are put into the ground with the seed by means of a drill machine, calculated for the purpose. The quantity allowed is from sixteen to twenty bushels per acre, but it is considered advantageous to mix them, a few days prior to using them, with half the quantity of vegetable ashes. They have been made available at Scoreby for the turnip crops pretty extensively, and very good crops have been raised from them. But when

these are drawn from the land, the succeeding crop is not so good as it would have been had farm-yard manure been employed. Indeed it cannot be expected that so small a quantity of bones can extend its influence beyond a first crop, though it will be remembered that one good crop always produces manure to raise another good crop. Bones have also been applied at Scoreby as a top dressing for grass, both singly and mixed up with earth. The latter is the best mode. About fifteen bushels well mingled in five tons of earth, and allowed to remain in that state during the winter, form a valuable aud a cheap manuring for an acre of meadow or pasture land.

Bones may be purchased to any extent, at the rate of from two shillings to two shillings and sixpence per bushel; and one waggon load will suffice for four acres of land.

A farmer of capital and judgment will find that half the quantity of stock well kept will afford a greater return than double the quantity will do if ill kept. He will remember that the cost in rent, taxes, and seed are equal, whether the crop be good or bad; and this will induce him as an axiom to drain well, clean thoroughly, manure highly, crop moderately, and hoe freely.

FARM REPORTS.

EAST RIDING OF YORKSHIRE.—THE WOLDS.

FARMING AT WAULDBY,

THE ESTATE OF ROBERT RAIKES, ESQ.,

OCCUPIED BY THE MESSRS. WATSON.

COMMUNICATED BY

MR. CHARLES HOWARD, MELBOURNE, YORK,

JANUARY 15, 1833.

"Agriculture not only gives riches to a nation, but the only riches which we can call our own, and of which we need not fear either deprivation or diminution."

DR. JOHNSON.

CONTENTS.

INTRODUCTION.

In the Fifth Number of "Reports of Select Farms," published under the superintendence of the Society for the Diffusion of Useful Knowledge, it was stated that the East Riding of Yorkshire might be divided pretty equally into three natural parts. That Number, under the head of "Farming at Scoreby," contained an account of the mode of cultivation adopted on the extensive plain which occupies the western boundary of the East Riding. The present Number is intended to depict faithfully the Husbandry which is practised upon one of the best cultivated farms situate upon that elevated chalk and limestone soil called "The Wolds;" and it is proposed to complete a survey of the varied surface of the East Riding of Yorkshire in another Number, by a Report from a large and most scientifically-conducted farm in Holderness. Though these districts adjoin each other, they are essentially distinct in soil, cultivation, and climate; and each will be found to possess an interest peculiar to itself.

The extent of The Wolds, in one continuous line from north to south, that is, from Malton on the Derwent to the village of Brough on the banks of the Humber, is about 30 miles. In breadth, from east to west, they vary much, but average about 12 miles. In the very excellent "Survey of the East Riding of Yorkshire," which was drawn up by Henry E. Strickland, Esq., and published by the Board of Agriculture in 1812, The Wolds are, with great accuracy, thus described:—

"The climate, in consequence of their great elevation, and their almost total want of wood and shelter, is severe and variable; the winds being extremely violent and penetrating, and by promoting a rapid evaporation, greatly aggravate the cold of the climate. This district has great uniformity in its general character. The northern and western fronts are towering and precipitous, from which it gradually and insensibly sinks into the low country of Holderness. It may in general be said to have a moderately waving surface, intersected with numerous deep, narrow, winding valleys. The soil of The Wolds is, with little variation, a light, friable, calcareous loam from three to ten inches in depth, and on the hills covering a chalk rubble from twelve to eighteen inches thick, below which the chalk rock lies to an unknown depth."

DESCRIPTION OF WAULDBY.

Wauldby is a small township in the parish of Elloughton, beautifully situated on the southern extremity of The Wolds, four miles north of Brough, four miles east of Cave, nine miles south of Beverley, and ten miles west of the town of Kingston-upon-Hull. It forms a part of the extensive estates of Robert Raikes, Esq., of Welton House, whose residence lies about a mile to the south of it. This is a scene of beauty which can scarcely be surpassed in the kingdom. The grounds afford a perfect combination of all that is most interesting in nature and in art; the view, far beyond the spacious lawn, is enlivened by the ships and small vessels that are constantly navigating the river Humber, which is

furrow, and at the same time conveying bone-dust or other hand manures into the furrows which are formed by the coulters for depositing the seed. When turnips are sown upon the single ridges, without hand manure, the small drill, called the Scotch Barrow, is used, which is attached to a light roller extending over two ridges, and consequently levelling the land *before*, and covering in the seed *after*, it has been deposited upon a ridge, at the same time. A drill is also used here, and it is thought with advantage, which is not in common use in this part of England, for sowing clover seeds. This is formed by a box of twelve feet in length, in which a brush is placed from end to end; the quantity of seed is exactly regulated by the number of holes left open for it to pass through; and, judging from the great regularity of the appearance of the pastures which have been sown with it, it does certainly spread the clover seeds with much evenness over the whole surface.

The threshing machine is powerful and answers the purpose well, and the labourers have the good sense to know that their own interests are combined with those of their masters; consequently there is no popular feeling against this most useful machine. The abundance of small flint-stones which are contained in the soil causes the plough-irons to wear with an astonishing rapidity, and a smith's shop is found to be absolutely essential on the premises, to keep these in order, as also to repair the harrows and minor implements, and shoe both horses and oxen.

MODE OF CULTIVATION.

The great object at Wauldby is to obtain full crops of whatever grain or roots it is intended to cultivate; and every means are employed that can promote it. No expense is spared either in cleansing or fertilizing the soil. A regular course is adopted to equalize as much as possible the proportions of green crops, of corn, of grass, and of labour; but this course is varied according to circumstances, that the end may be more completely attained. All the crops, of every description, are drilled, and kept perfectly free from weeds during their growth; and it is astonishing to see how greatly that work is lessened by steady attention, and perseverance in eradicating all weeds before they ripen and scatter their abundant seeds. The course of cropping, which is most universal, both here and generally upon the district of The Wolds, is

Turnips—chiefly consumed where they grow by sheep.
Barley—sown with white clover or mixed grass seeds.
Pasture—principally stocked with sheep.
Pasture—part of which is fallowed after Midsummer.
Corn—of which part is wheat and part oats.

This may be considered the old and legitimate course; but to prevent the too rapid succession of the same crops, and especially of the clovers and grass seeds, it is found necessary to change this plan in a variety of circumstances, and the following course is occasionally introduced:—

Turnips.
Barley—the stubble of which is manured after the harvest.
Beans—peas or tares, very well hoed.
Wheat.

This course is also again, in some cases, altered by the substitution of red clover, in lieu of the beans or tares after the barley. As it is of the most material consequence to have at all times an ample quantity of food of good quality for the very extensive flock of sheep and number of cattle kept at Wauldby, a pretty equal production of grass is absolutely requi-

site. It is well known to every cultivator of clovers and grass leys, that no care or attention can always insure success. The seed will sometimes be partially destroyed by too much rain falling immediately after the clover is sown; at others, the plant will fall a sacrifice to drought before its roots have sufficiently penetrated the earth to nourish it. It is not unfrequently destroyed by insects: and again, in weather especially favourable for the luxuriant growth of straw, the clover may be smothered, by the barley crop excluding it from the sun and the air. When from any of these circumstances the grass leys prove deficient, that were intended for a two years' pasture, they are ploughed out at Midsummer, and are then fallowed for wheat. In this case, in order to equalize the quantity of pasture, it is necessary to allow some of the best leys of the preceding year to remain in grass a year or two longer than had been originally intended. An intelligent cultivator will often be able to benefit himself, and improve the estate he occupies, by an occasional departure from a regular system of cropping. Seasons, and circumstances over which he has no control, frequently require it, and no injury can arise from it as long as the farm is kept in high condition, and a due equilibrium is maintained between the arable and grass lands, and proportion of lahour for future years. It must however be acknowledged, that there are too many farmers who can only be compelled to do justice to the lands they occupy by being yoked like a mill-horse to a beaten track.

TURNIPS.

The preparation for this crop, which may justly be said to lay the foundation of all others upon The Wolds, commences as soon as the hurry of wheat-sowing is concluded. The wheat and oat stubbles are then ploughed to a full depth, that they may derive the utmost benefit of the winter's frost. Early in the spring every exertion is made by the constant using of the drag-harrow and occasional ploughing to get the land, especially that portion of it intended for Swedish turnips, into the most perfect state of cleanness. Any root-weeds that appear, in consequence of a wet season, still to retain the power of vegetation, are carefully picked off and burnt. About the 14th of May, the Messrs. Watson usually commence sowing the *ruta baga* or Swedish turnip. The land being prepared, and a large quantity of good rotten manure having been dragged into the field from the farm-yards during the winter's frost, and undergone the process of fermentation by being duly heaped, two ploughmen commence forming ridges, about twenty-six inches apart: this is done with either one or two horses; and though the double mould-board plough will save the labour of one man, yet the operation by it cannot be performed with an equal degree of neatness and accuracy. At the same time three or four single-horse carts are brought into the field, and the manure is immediately deposited into the open furrows, and neatly spread therein by women and boys, who follow the carts. As soon as sufficient space is gained to keep the carts at work, the ploughmen return, and with double mould-board ploughs split the ridges, which they had just before formed, thereby completely covering in the manure. A Scotch barrow-drill, attached to a very light roller, deposits the seed at the rate of two pounds per acre. This might be done in less time by using a double drill; but the advantage would be more than counterbalanced by the difficulty of making the ridges so exactly apart as not to render the turnips liable to be cut up by close horse-hoeing; which they would be if they did not spring up precisely on the centre of the ridges.

Manure is always used for the Swedish turnip, but sometimes in addition to a plentiful supply of it, from twelve to sixteen bushels of bones are drilled upon the ridges with the seed. This is a most valuable, but, in this district, certainly a most precariuus crop; and no little anxiety occurs to the cultivator whilst watching the progress of its early growth. There is usually a struggle for ten days after its appearance above the ground between the vigour of the plant and the ravages of the turnip-fly, which invariably appears in greater or smaller numbers, as soon as its favourite food presents itself. No remedy has yet been discovered to protect the plant from this destructive insect, which is fuund alike on all soils, and in all climates in Britain. To a considerable extent, however, they may be checked by introducing the horse-hoe between the rows, as soon as the plants rise above the ground, and repeating the operation every two or three days. The advantage of this is double, as it not only destroys many of the flies, but at the same time greatly promotes the rapid growth of the turnip. When the plants have obtained sufficient size of leaf and vigour to bid defiance to the fly, they are set out in the rows, about eight inches apart, and carefully singled by the hand. The intervals are then kept clear from all weeds by the free use of horse and hand hoes.

About one third of this crop is drawn from the land in January, February, or March, as the weather will permit, and having the tap-root cut off, is *paved* as close as possible in the corner of a grass field fur late spring use. This effectually preserves the turnip either from decay or becoming woody. It prevents further exhaustion of the soil on which it has gruwn, and leaves the land in readiness to be sown with corn in due time, which could not be the case if the turnips were permitted to occupy it until they were consumed.

Early in June the Messrs. Watson begin to sow the white turnips. The preparation of the land and method of sowing a part of these is precisely similar to what has been already stated for the Swedes. But for those intended for consumption after Christmas, a somewhat different plan is adopted. The whole breadth of this land is manured lightly, duly spread, and ploughed in as soon in the season as possible. A compost is formed of fourteen bushels of half-inch bones, forty-five bushels of rich Hull manure, which is principally composed of coal ashes (carefully riddled, to prevent any large substance from choking up the drill) and twenty-five bushels of dry vegetable ashes. This is the quantity fur one acre. The land being previously brought into fine order, is ploughed level, as for a grain crop; and immediately after the plough, the large drill follows, depositing the seed at the rate of two pounds per acre, and the above described compost at the same time with it, in rows twelve inches apart. The system, however, of horse and hand hoeing is the same on these later sown turnips as the earlier ones; they do not acquire so large a size, but stand thicker on the ground, and will keep better. Though the expense of procuring the bones and manure from Hull is very considerable, the benefit is found by experience amply to repay it. Without the aid of bones, turnips could not be raised to near the extent they now are, and the consequence would be, that summer fallows must be resorted to. These are now never seen at Wauldby, and the land is kept in higher condition, and as perfectly free from weeds as it could be by the unpruductive process of summer fallowing. Bunes evidently give more vigour to the turnip than to any other plant, and seem to be of greater efficacy upon the Wold farms than upon any other soil. The addition of the ashes promotes rapid vegetation in the early stage of the plant. The variety called the white stone turnip, is

decidedly the favourite here, and considered to bear the severity of frost better than any other white turnip.

RAPE.

A portion of the fallowed lands have for the last few years been sown with rape, solely for the use of the sheep; it is cultivated exactly in the same manner as has been described for the last-named turnips, but not thinned in the rows, though well hoed between them. The quantity of seed used is 4 lbs. per acre. To afford a regular succession of food, it is sown at three different periods, between the middle of May and the end of June; and the sheep are usually put upon it three months after it has been sown. A considerable quantity of the very best food is thus raised, to come in at a period when it is most wanted, viz. when the freshness of the clover and grass leys is on the decline, and before the turnips are fully grown. It is considered equally valuable for the lambs when taken from the ewes, and for the shearing wether sheep eighteen months old, which are at that period nearly fat, and require food of the most nutritious quality. The land is afterwards sown with wheat, and the crop is usually considerably heavier than it is after turnips or any other preparation of Wold land.

POTATOES

Are not cultivated to any extent here: a few are grown for domestic use, and some are given to the pigs; but the quantity is small, and no particular attention is paid to them. The soil does not seem favourable for a large produce, and they are not considered to be a crop which yields a sufficient return to defray the trouble and expense of raising.

WHEAT.

About the middle of September is considered the proper time to commence putting this seed into the ground, and if possible all the seed is sown between that period and the 10th of October. A most material difference occurs in the cultivation of this crop, between this district and the western division of the East Riding. *There* the preparation is almost invariably a summer fallow, whilst *here* a summer fallow is never made. *There* scarcely any wheat is sown before the 10th of October, and *here* as little is sown after it. As soon as the busy period of turnip-sowing has passed over, some of the two year old grass leys are ploughed out, and thoroughly broken up with Finlayson's drags and other harrows. If any couch grass appears, it is carefully gathered up and burnt, and by repeated harrowings and two more ploughings, the land is brought into fine order to receive the seed. This is drilled at the rate of eight pecks per acre, the rows being nine inches apart. This is an alteration from the old mode of husbandry, according to which, the wheat crop was sown upon the grass leys immediately after a single ploughing, and the use of the drill was unknown. That the modern practice is a most decided improvement, is evident from the greatly increased produce of the crop, and by the decreased labour required to make a clean fallow for the turnips that succeed the wheat.

But though the bulk of the crop is raised upon the land thus prepared, it is sometimes found requisite to vary the course; and wheat is sown also after rape, red clover, peas, beans, or tares. It is then sown upon a single furrow; that is, upon land which has been only once ploughed. This land is, however, perfectly clean, and if any weeds do appear, they are also carefully harrowed up, and gathered off before the drill deposits the seed. During the growth of this crop the intervals are well hand-hoed, and the corn in the rows diligently weeded; but it is probable that this might be

better effected, and the produce of the grain increased if sown at wider intervals, say in rows at twelve inches apart *. The varieties chiefly in use are the Boswell red, the creeping, and the Talavera wheat. The old practice of sprinkling the seed with a solution of arsenic, in the proportion of one ounce for every bushel of wheat, is still occasionally resorted to as a preventive for the disease called "smut." But it is found by experience that washing the seed very well in water strongly impregnated with salt answers the purpose equally. It is dried, as usual, with a dusting of quick lime, but the vegetative power is apt to be destroyed, if permitted to remain long in sacks or in heaps before it is sown.

In harvesting this crop, the scythe has taken the place of the sickle; all the weat is mown, which is an operation conducted with much greater facility than shearing, and when well done, as it is here, possesses several advantages. A considerably larger quantity of straw is obtained than can possibly be done with the sickle; and in wet seasons the corn is much less liable to be sprouted in the sheaf. This circumstance can arise only from the straw not being so compact, and consequently admitting the air more freely; and that this is the case is further proved by the observation, that mown wheat is always in condition to carry to the stack a day or two sooner than that which has been shorn. The price paid for mowing, binding the sheaves, setting them up, and raking the scattered ears, is from seven to nine shillings per acre. Though much heavier crops of this grain are obtained since the alteration of the old system, which look well and even upon the ground, yet they are not so productive upon the Wold lands as they are upon the clay soils on the eastern and western side of them, though perhaps somewhat more regular and certain. Here three quarters per acre is considered a very good and satisfactory return. The grain is, like the growing crop, even and fine, but not so large and heavy as that which is raised on stronger soils.

BARLEY.

When the land on which the turnips have been grown is cleared of them, it is ploughed, and minutely divided by the free use of large and small harrows in the spring, as early as they will work with advantage. To effect this, it is, however, necessary that the weather should be tolerably dry, for in wet seasons the soil is only rendered more heavy by working upon it. When this proves to be the case, an extra ploughing is sometimes requisite to bring the land into a proper state of tilth to receive the barley, which crop grows with most luxuriance when the soil is rendered friable. Early sowing is preferred, and this work usually commences about the 15th of March, and is finished about the 15th of April. Three bushels are drilled upon the acre, at a distance of nine inches between the rows; and when the land has been harrowed after the drill, the clover or grass seeds are sown among the barley, and covered by the light harrows passing once over them. In this case, it is evident that the greatest advantage arising from the drill husbandry, that of complete and effectual hoeing, is unavoidably lost; because, after the red clover or other grass seeds are sown, the hoe cannot be used. Yet even here it is found that the drill has its use, not only in depositing the grain at a regular and proper depth, but also in affording more space for the young grasses to grow in, and thereby causing them to vegetate more freely and luxuriantly than they can do where the grain is scattered indiscriminately over the land by being sown broadcast.

* A considerable saving in the seed corn would also be made, it not being usual to drill more than six pecks per acre when the rows are *twelve* inches apart.

When the land is not sown with clover, the intervals are freely hoed, and hand-weeded if requisite.

When ripe, the barley is mown *inwards;* that is, towards the standing corn, and instantly bound into sheaves, unless the young clover plants have grown with great vigour; in which case it is mown *outwards* like grass, and allowed to remain one or two days in the swathe, to dry the clover before it is bound into sheaves, and set up in stooks. The general price for harvesting barley is six shillings per acre. A very large quantity of this grain is grown at Wauldby, and indeed upon the Wolds generally. The light calcareous soil is admirably calculated for the cultivation of it, and heavy crops of good quality are produced. As the straw retains its succulency longer after it has been cut than that of other grain, and as it is frequently mixed with the young grasses sown with it, considerable caution is required to prevent fermentation in the stack. It is on this account desirable to give it much time to get completely dried in the field before it is led. If heated but in a slight degree in the stack, the grain becomes high-coloured, and its value consequently deteriorated; and if much fermentation take place, the vegetative powers are destroyed, and it of course becomes entirely worthless to the maltsters. The average crop, with the high management bestowed upon it here, may be calculated at about thirty-six bushels per acre.

OATS.

Formerly oats were the principal crop cultivated at Wauldby, but since the improvement which increased knowledge and attention have occasioned, a great alteration has taken place in the general arrangement of the system, and in the course of husbandry. A greater number of acres are now sown with both wheat and barley than with oats. These are now grown only on some of the deeper soils after turnips, which are not so well adapted for barley, and also upon some parts of the two year old grass leys, which are found not so well suited for wheat.

There is also another object which is not forgotten, and which sometimes occasions the introduction of oats, which is that of *change.* For it is obvious that all lands are rendered most productive when the recurrence of any one crop is not too frequent. If, therefore, in two courses, occupying nine years, a field had twice borne a wheat crop to the exclusion of oats, it would in the next rotation be eligible to substitute the latter for wheat. A farmer can never pursue one regular system with advantage either to himself, or to the land which he occupies. Whilst, therefore, he acts upon one great plan, it will be necessary to make continual small deviations, which will be directed partly by his own judgment, and partly by seasons and other circumstances.

As soon as the land is in a state to harrow after the winter ploughing which the grass leys that have been pastured two years have received, it is thought the proper time to sow oats, whether it be the close of February or the beginning of March; for the state of the weather is more to be regarded than the day of the month, in all agricultural operations. Early sowing is decidedly advantageous where the land is in high condition, as it is found not only to occasion early maturity, but also to produce the largest quantity and finest quality of grain. On poorer soils a more bulky crop of straw at least, and perhaps of corn, is raised by sowing a little later; as a check in early vegetation, where the land is not in heart, is seldom entirely recovered.

In all cases, whether the oats are intended to be sown upon the grass

leys, or upon the deeper soils where turnips have been previously grown, one ploughing only is given for them. The land having been well harrowed, is immediately sown with the drill at the rate of five bushels per acre, leaving a space of nine inches between the coulters of the drill.

The varieties chiefly in use are what are called the early Scotch, and the Infield, and the Tartarian oats; the latter sorts are probably the most productive, both in the straw and corn, but the former affords better fodder, and a finer sample of grain, and ripens considerably sooner than the Tartarian. The Friezland oats, which used to be cultivated here almost exclusively, are now little used. This crop is cut entirely with the scythe, and bound up in sheaves and stooked in the manner before described. The price for executing it averages from 6*s.* to 8*s.* per acre.

BEANS.

Beans have not been usually considered at all applicable for wold lands: yet it has been found that to introduce them occasionally with other crops is attended with much advantage; and at Wauldby they are now frequently sown upon an oat or barley stubble. Such lands as are intended for this crop are manured in the winter upon the stubble, which is then ploughed, and remains in that state until February. An opportunity is then taken, in moderately fine weather, to harrow very fully and drill in the beans at twelve inches distance between the rows. These are repeatedly hoed, and grow very freely, leaving the land in fine order for a succeeding crop of wheat. The deepest soils are selected for the purpose; and this mode of cultivation affords a most judicious and admirable change from the general system of turnips, barley, grass, and wheat. It prevents a too long and frequent recurrence of the clovers; and when it is considered that all the crops are drilled and kept perfectly free from weeds by hoeing, and that the stubbles are manured previously to ploughing them for the beans, it will be evident that this course has no tendency to exhaust the soil, nor in good lands, and with tolerably favourable seasons, can it encourage any approach to foulness. Beans are usually sown alone, but they are occasionally mixed with a small portion of tares or late peas. The quantity of seed used is at the rate of three bushels per acre, and the produce varies between sixteen and twenty-four bushels per acre.

PEAS.

The lighter description of land, after having been prepared in the manner already mentioned as for a bean-crop, is sown, in preference to them, with peas. In the month of March, three bushels of the spreckled or partridge peas are drilled at the distance of eight inches; the intervals are kept clean, and the growth of the plants encouraged by repeated hoeing. When ripe, they are generally mown with the scythe; but if much laid, and in different directions, they are reaped with the pea-hook. In either case they are put into small heaps to dry; and as considerable waste is incurred by turning them, this is avoided if possible, though if the season is wet during the harvest it becomes necessary.

The produce is very uncertain; they are subject to be preyed upon by a variety of insects, and not unfrequently damaged by mildew. About four quarters per acre is accounted a good crop. The principal demand for this description of pea is for fattening pigs, for which purpose they are decidedly preferable to barley. When well hoed in the early stages of growth and they become a full crop, they completely smother the weeds that may spring up afterwards, and cover the whole land, which is left in a very fine

and mellow state for the reception of the wheat usually sown after them. The Messrs. Watson have observed, however, that the wheat sown after peas is much more liable to break down than that which is sown after beans. But this fact may be attributed solely to the lightest parts of the land being selected for peas.

TARES.

The variety called the winter tare is the sort which is decidedly preferred. These are sometimes sown at Wauldby upon a barley stubble, which has been previously manured, to stand for a crop; the earlier they can be got into the ground the better the produce. Two bushels per acre are drilled at nine inch intervals, which are hoed in the spring. About thirty bushels is accounted a good crop. They are cut down either with the scythe, or the pea-hook, and not tied up, but laid in small cocks to dry, as has been before stated. It is an uncertain crop, which occasions the price of them to vary considerably; and in a wet harvest they are liable to great injury from sprouting.

Some are always sown as near to the farmstead as circumstances will admit, to be mowed as green food for the use of the horses in the summer. For this purpose it is a most valuable crop: producing a great quantity of nutritious food on a small space of ground, and consequently collected with very little trouble. To keep up a regular succession, they are sown at two or three different periods. A little rye is found useful to support the plants from lying so much upon the ground as they are apt to do; and a few oats are mixed with those sown in the spring for the same purpose. Even for this period the Messrs. Watson prefer the seed of the winter to the spring tare, and usually sow it. Horses, cattle, and pigs, are equally partial to them, and the consumption of it in the farm-yard occasions a vast quantity of most valuable manure to be made through the summer months.

RED CLOVER.

Red clover is sown with the barley on a part of the land after the turnips have been consumed, for the purpose of making into clover-hay. It is also sometimes pastured during the spring and summer with sheep, and then fallowed rapidly to promote the growth of a succeeding wheat crop. It is found serviceable in maintaining a considerable flock through the months of May, June, and July; but after being *pastured* during that period, it is of little value, though when *mown*, the second crop grows with great luxuriance. There is no better food for draught horses than well-gotten clover-hay; and as this district affords but little meadow-land, it is an excellent substitute for hay. The usual practice is, to leave it in the swathe for two days after it is mown, and then to turn it over with rakes and put it into cock as soon as it is sufficiently dried. If shaken its leaves are scattered upon the ground, and consequently much of the crop is wasted. When the clover is heavy, and hands plentiful, the best mode of making it into hay is to gather it into sheaves soon after it is mown, twisting them together at the top, and opening them out at the bottom, in the form of a sugar-loaf, and then to place them singly along the line of the swathe. In this case, whether the weather prove favourable or otherwise, nothing more is, or can be done to them: they stand there until ready to lead to the stack, and are forked singly into the waggons. This is provincially termed "ruckling:" it is a name and a practice but little known, though where it has been introduced it has been found most valuable, especially in precarious seasons.

This plant is also applied with great benefit for the purpose of soiling; but in this case it is absolutely necessary to grow it near to the farm-yard, otherwise the advantage is lost from the increased expense of labour. With this view it is found expedient sometimes to sow it with spring tares; and it succeeds very well with them, mixed with a few oats or beans, for the purpose of supporting the tares. But close attention must be paid to mowing the tares very early, to prevent their smothering the clover, which they will certainly do if allowed to *lie* upon the young plants. In this way two cuttings may be obtained the first year, and three the second year.

There is no better or more profitable application of manure than on red clover, when intended for soiling, though the quantity used should not be very large, and it should be in such a state as not to cover the plants heavily. For this purpose, town manure freely mixed with ashes or soot is peculiarly beneficial. A slight dressing may be given in the month of March, and another immediately after the first cutting of the red clover.

The land that has been put into high condition and thoroughly worked for barley, is in the best state to receive clover-seed for a general crop. When intended for pasturing, 14lbs. per acre is the usual quantity allowed; but the Messrs. Watson are of opinion, that from eight to ten pounds of a fine purple kidney-shaped seed is preferable to a larger quantity for mowing, that the plants may have room to expand themselves. They also prefer drilling clover to sowing it broad-cast. This drill has been described under the article "Implements."

GRASS LEYS.

To maintain the large flock of sheep that are bred and fattened at Wauldby, it is necessary to pay great attention to the culture of grass. A considerable quantity of the land, therefore, that has been duly prepared for barley is sown also with a mixture of seventeen pounds of white clover-seed, two pounds of rib-grass, and if not intended to be sown with red clover in the next course, three pounds of that seed; this, with three-quarters of a peck of rye-grass, is the proportion for one acre of land. As soon as the drilled barley has been harrowed in, these seeds are sown, and covered by light and short-teethed harrows passing once over them. In the autumn, after the barley has been taken off the land, the young grasses are pastured for a short time by lambs; but it is observed, that the less they are eaten at that period, the more vigorous and early is their growth the following spring: this is therefore done with caution if the growth has been luxuriant; and if, from being too much shaded by a heavy crop, the grass-seeds are weak, they are not pastured at all in the autumn. A week's grass in April is of more value than a fortnight's feed in September.

Much advantage is found to arise from the mixture of stock kept upon these leys: formerly they were eaten solely by sheep; but though these still form the principal part of the stock, they are now freely mixed with young short-horned cattle, which, by cropping the coarser and more luxuriant parts of the herbage, tend much to sweeten the pasture, and consequently to the thriving of the sheep.

Though within the last forty years an immense quantity of old grass-land of a sweet but not very productive quality has been ploughed out upon the Wolds, and this very much to the advantage both of the proprietors and the occupiers, where a good system of husbandry has been carried on afterwards, yet has there been very little attempt to restore any of these lands again to permanent grass in an improved state. When, above fifty years

ago, the respected father of the Messrs. Watson became a tenant upon this estate, the greatest part of what is called "The Green" was a sheep-walk, covered with a sweet close herbage of dwarfish growth, thickly intermingled with furze and stunted thorns. This was progressively enclosed, cleared, and converted into arable fields; and now the green is reduced to less than half its size. Great benefit has resulted from the change: the land has been prodigiously improved; it has borne a constant succession of valuable crops of corn, or productive fields of green food or grass-leys for sheep and other cattle. Independently of the quantity of grain that has been raised upon this land, the quantity of live stock which it maintains has been more than trebled: consequently, great wealth has been *created* by the system, though but a very small portion of it may have ultimately settled in the possession of those by whose skill and industry it has been raised.

Great attention is paid to the extermination of all noxious weeds that show themselves upon the grass leys, the principal of which is the thistle in its endless varieties. If these were permitted to shed their abundant seeds, the whole surface of the land would soon be covered. In the month of June, therefore, before the seeds are formed, the pastures are carefully gone over with the scythe, which is again required in August. Nothing is more unsightly to the eye of a good farmer, nor more visibly proclaims the sloven, than pastures abounding in thistles: they occupy the place of much good grass, and spread themselves over all the neighbouring arable fields. It is good economy to watch them narrowly, and destroy them before they show their blossoms.

FORMATION AND IMPROVEMENT OF PERMANENT GRASS.

Though the ancient "Green," which used to be a sheep-walk to the extent of one-third of Wauldby, has been reduced by the plough to about one hundred acres, yet other lands have progressively been laid down to grass, and the permanent pastures now consist of upwards of two hundred acres. Much objection has been made to converting old grass-land on light or thin soils into an arable state, on account of the supposed impossibility of again restoring them to permanent grass. That it may be done, however, and in a most highly improved state, has been fully proved upon this extensive farm. There are now fields of grass that have been laid down *about thirty-five years ago*, affording abundance of herbage of a fine quality, of four-fold the value of the ancient green. These fields have of course been much encouraged by the consumption of turnips frequently brought upon them for the sheep, and also by occasionally manuring them. Yet they prove to demonstration, that grass of a richer quality may be raised with care than the original covering given to them by nature; and that good permanent grass fields may be restored upon the Yorkshire wolds.

In detailing the mode of cultivating the leys intended for a two years' pasture, it was observed, that there was a certain portion of ray-grass sown with the clover-seeds. The kind usually adopted for this purpose has been that which is known by the name of Pacey's perennial rye-grass; this is more leafy, and spreads more over the ground than that which used formerly to be cultivated under the name of the tall or annual rye-grass. There is, however, a new variety of rye-grass cultivated at Wauldby, which appears to the Reporter to be as much superior to Pacey's as this latter is to the annual species. The plant alluded to is called "Stickney's rye-grass." This forms a closely-matted sward, is abundant in produce, and continues to exhibit a beautiful verdure through the summer. It is pro-

bable that an increased knowledge of this grass will greatly promote the formation of permanent pastures, for which purpose it seems likely to be of essential value.

The Messrs. Watson find linseed-cake and turnips added to straw is an excellent substitute for hay, and prefer mowing red clover to reducing the quantity of the old pasture eatage, or deteriorating its quality; consequently, but little of the latter is subjected to the scythe. Land of this description is particularly valuable for the ewes during the lambing-season, and a few Swedish turnips given to them, and to the young cattle upon it, afford equal benefit to the stock and to the land. Indeed, it is from the constant winter and spring-feeding in them, that their greatly improved state and high luxuriance is to be attributed. During the summer months these old grass-lands are stocked pretty equally with horned cattle and with sheep, and they make an admirable change from the grass-leys.

HORSES.

A considerable number of horses are requisite for the cultivation of this extensive farm; and the description employed is admirably suited for the purpose, combining a necessary degree of strength with much activity. The predominant colour is bay, but this is not regarded. Much attention is paid to obtain them with sufficiency of bone and clearness of sinew, lively in appearance, and quick in pace. Generally speaking, they are exactly what are required for the wheel-horses in stage coaches; and being kept in high condition, they get through an astonishing quantity of work.

Many horses were formerly bred at Wauldby; but latterly, from various circumstances, this has been declined. They may certainly be reared with a greater probability of advantage in lower situations where rough pastures abound, which are less eligible for the breeding of sheep. Horned cattle are decidedly a preferable stock to mix with sheep, and tend to keep the fields more equally depastured, as they like a full bite of grass, though the herbage be not quite so sweet. The demand for horses has been greatly lessened since the termination of the war. Independently of the vast numbers annually required to supply our regiments of cavalry and horse artillery, it has been supposed that a considerable diminution has taken place in the quantity required for the coaches since navigation by steam has been brought into use. Should railways and locomotive engines continue to increase, the demand for horses would in some districts be diminished. It has been stated that nearly one thousand horses have been thrown out of employ on the roads between Liverpool and Manchester since that railroad has been established.

SHEEP.

The whole of the Yorkshire Wolds are exceedingly well calculated for breeding and maintaining sheep. These are therefore very properly considered the main stock upon the land; and they are brought to a degree of perfection, seldom witnessed on so large a scale, in other parts of England. These flocks are generally designated the "Wold sheep;" they greatly resemble the Leicesters, from crosses of which breed, and the heavy and long-woolled sheep of Holderness, on the original Wold flocks, they have been raised to their present valuable form and excellent qualities. They have a fine head, free from horns, full and lively eyes, thin and rather long ears, a level and broad back, with a particularly round and full carcase; the bone in the leg is light and clean, which, when the sheep is newly shorn, appears rather long. The pelt or skin is thin, and remarkably

soft and mellow to the touch. The wool is long, open, and has a tendency to curl in single ringlets.

The breeding flock at Wauldby consists of from five to six hundred ewes of the above description. They have been crossed at different periods by rams bred by Mr. Ombler of Cammerton, in Holderness; Mr. Clark of Canwick, in Lincolnshire; and Mr. Earnshaw of Whitley, near Ferry-Bridge, &c. &c. The wether shearings will average, at one-and-a-half year old, about 33 lbs. per quarter; and the first clip of wool is about seven pounds weight. The greatest care and attention are paid to the improvement of the flock by annually drawing out the oldest and least perfect ewes, and then making up the number by an addition of the finest gimmer shearlings. Those only are retained for ewes which are the most perfect in shape, in fineness and weight of wool, and which evince the greatest tendency to fatten. The size of the sheep is not so much regarded as its qualities; though, generally speaking, both the largest and the smallest are rejected. By this means the flock is kept more equal in size; and by a careful and judicious choice of rams, not only good in themselves, but well-adapted for the ewes, a progressive improvement is made in the whole stock.

The rams are put to the ewes on the 10th of October; about seventy ewes being allotted to one ram. A few weeks previous to that period, the condition of the ewes is improved by turning them into good and fresh pastures; or, what is preferred, upon rape. This not only encourages them to receive the tup more freely, but has also a great tendency to render them more prolific, and thereby to increase the number of double lambs. About the 20th of November the rams are sent home again; and after that period the ewes have only the unploughed stubble-fields and grass-land allotted to them, unless the weather is very severe, and a deep snow covers up the herbage; in which case they are fed with hay. In the month of February, however, they begin to require more attention and better keep, and are generally put upon turnips, in order to encourage the secretion of milk, and enable them to maintain their lambs. These are usually dropped in March and early in April, and demand the constant care and attendance of the shepherd, both night and day. A well sheltered field of old grass, near the farm-yard, and a plentiful supply of Swedish turnips carted to it, is the best situation and food for them, at this critical period. As the lambs gain strength, they, with their dams, are taken to more remote fields; but every exertion is made to supply them plentifully with food, until the young grass vegetates freely. The males are castrated at about the age of ten days, when both they and the gimmer lambs have their tails cut. They are weaned early in August, when the lambs are put into the best, and the ewes into the worst, pastures upon the farm. It is necessary to watch the udders of the latter, and occasionally to draw a little milk from those which appear to be distressed by it, and show any symptoms of inflammation. If rape can be spared for the lambs, it greatly encourages their growth at this time, and promotes their condition. During the whole of the winter they are kept upon turnips, folded off with nets; but are allowed ample space to range over the eaten ground. When the weather is frosty, they have a few fresh turnips every day; but when it is open, larger quantities are given them at a time. A moderate supply of hay, or oats chopped in the straw, unthrashed, is of great service in keeping them in health, and correcting the laxative property of the turnip.

When upon turnips, the wether hogs (*i. e.* lambs) are separated from

the gimmers, and indulged with the very best food, that they may be fattened as speedily as possible. The operation of shearing is performed in June, and the wool is either sent by water-conveyance to Wakefield to be sold by a commission agent, or it is disposed of to some of the numerous West Riding wool-buyers who travel about the country for the purpose of purchasing it, at this period of the year, from the farmers. The agreement is made by the tod, which the dealers have contrived to enlarge to 28½ lbs., the value of which is this year about 30*s.*, taking together an equal proportion of hogs and ewes. The hog wool (that is, the wool of the sheep shorn for the first time) is worth about 2*s.* per tod more than that of the ewes.

As soon as these sheep are clipped they lose the name of hogs, and are then called wether and gimmer shearlings. The wethers, which began to be favoured upon the turnips, are always allowed the best pastures, and in August they are put upon rape. In September, though they have not attained their full growth, they usually become very fat, and are either sold at that period, or are kept on the farm, upon turnips, to the early part of the winter, as the quantity of food and other circumstances may direct. In this case, they will increase in weight so much as to average about 25 lbs. per quarter.

On the 25th of September, there is held annually a very large sheep fair at Weighton, at which a vast number of prime wedder shearings, as well as excellent ewes and lambs, are exhibited from the Wolds; and show in a most striking view the excellence of the breed, and the pains and care bestowed upon the flocks. Towards the close of the late war, when every exertion was rewarded by profit, these sheep were still more an object of attention, and as many as 80,000 have been collected together at the fair, amounting in value to nearly 200,000*l.*

The excellent constitution of the Wold sheep, added to the full supply of nutritious food, which is generally allowed to them, renders them not very subject to diseases. In this district, the most fatal of all,—the rot,—is unknown. A few are annually lost by what is called the sturdy, that is, hydrocephalus or water on the brain. The author of an excellent little Treatise on the diseases of sheep, recently published by the Society for the Diffusion of Useful Knowledge, entitled "The Mountain Shepherd's Manual," accurately describes the disease thus:—

"The water is contained in cysts or bags, unconnected with the brain, on which it acts fatally by pressure. Very soon after the water has begun to collect, the animal begins to show evident and decisive symptoms. It frequently starts, looks stupid, giddy, and confused, as if at a loss what to do. It turns round in the same place as if wishing to go away, but not seeing which way to escape, it retires from the rest of the flock, and seldom changes its position. When the skull is felt in any part to be thin and yielding, the hydatids are found underneath. If in this case the skull be opened, and the cysts removed, there is a chance of recovery. The animal must, of course, be confined, and the wound carefully attended to."

The reporter has, in several instances, seen this disease cured by the operation described. In the marshes in Lincolnshire, which is a low district of fine grazing land, the complaint is particularly prevalent; but as its victims are usually young sheep, and generally in high condition, it is best to kill them on the very first appearance of the complaint.

It is observed that sheep always thrive best when they have a frequent change of pasture, and a variety in their food. A due allowance of dry meat when they are upon turnips, both tends to promote their progress in

fattening, and to lessen the liability to disease. They are very partial to salt, and though it is not so necessary for them in this district, as in low and less healthy situations, yet it may be fairly presumed that it would be well-bestowed upon them here.

CATTLE.

In passing over the district of the Wolds, an observing farmer would be surprised to see so very scanty a stock of horned cattle. Many extensive farms might be found, on which five hundred sheep are maintained; and yet two or three milch cows form all the summer stock of beasts; and an addition of six or eight oxen purchased in November, and sold in April, all the winter stock. These latter are turned into the farm-yard for the purpose of consuming a small portion of the straw, and treading down what they do not consume, and thereby promoting its decay. They have nothing but straw to eat, and are consequently in worse condition when they leave it, than when they entered into it. No advance in value is expected, and they are not unfrequently sold for even less money in the spring, than they cost in the autumn. If cattle were made a greater object of attention, much benefit would result from them. The Wolds are decidedly best adapted for sheep; but these always thrive better when the pastures are not stocked solely with them. The grass is more equally eaten by a mixture of cattle, and thereby rendered sweeter and more palatable to the sheep. Beside which, to obtain the largest supply of good manure, ought to be an object of the first importance to every farmer. Upon the Wolds nothing but *hand* manures can be made available, from the heavy expense of carriage; the greatest part of the district being distant from conveyance by water, and the roads in all parts hilly, and in many very steep. To a lover of good agriculture, it is really melancholy to see the entire waste of straw, the produce of perhaps two or three hundred acres of corn land. This is often cast into a large fold-yard from the barn, in such profusion as entirely to bury a score of pigs, and not unfrequently to hide from the first view four or five oxen. Towards the spring this is turned over, with a view of promoting its decomposition, and soon afterwards spread upon the land under the incorrect name of manure; though it is still, in fact, little more than sullied straw, and of course can effect but little in promoting the fertility of the soil.

A divided fold-yard, well stocked with cattle and pigs, supplied to a moderate extent with turnips and other esculents, or a small quantity of linseed cake, would furnish a certain profit by the improvement of the live stock. But this would be only a small part of the advantage; the manure would be greater in quantity, and in quality it would be improved ten-fold. It is impossible to obtain a succession of good crops upon these lands, without an ample supply of animal manure, and every effort should be made to procure it, not only in the pastures, but in the farm-yards.

The practice in this respect at Wauldby is admirable. Though sheep may still be considered the main stock, yet the horned cattle are scarcely an inferior consideration; and the breed and the management of them are equally worthy of observation and imitation. About twenty years ago the present occupiers of this farm began to increase their number, and improve the description of their cattle, by hiring a bull from that noted breeder Mr. Collings.

This beast was got by the celebrated bull "Comet," who was so highly-esteemed as to fetch at Mr. Collings' sale, on the 11th of October, 1810,

by public auction, no less a sum than one thousand guineas. The advantages which resulted from this introduction of the very best blood of the short-horned breed, were so obvious as to encourage perseverance. Bulls have since been hired from the stocks of those well-known and judicious breeders, Mr. Mason of Chilton, and Mr. Thomas of Eryholme, in the county of Durham; Mr. Champion of Blythe, Mr. Wiley of Bransby, near York, and Mr. Whitaker of Burley, near Leeds. Though the Wold land is not considered to be sufficiently rich to raise this description of stock to great perfection, yet that it may be done by attention and good management is fully proved at Wauldby. It would be difficult to find upon any one farm in the county of York, a stock of short-horned cattle of equal number and value. The fattening of them is not attempted here; and the nature of the soil and the situation puts the dairy out of the question. About twenty calves are reared annually, the produce of heifers and of young cows, which have had only one calf before. April is considered the most eligible month fur them to be calved in, as they then calve in the cattle-houses, and the calves gain a little strength before they are turned out to grass with their dams, which are not milked, but allowed to suckle their young. They are usually brought under cover for a few nights at first, that they may be gradually inured to the weather; and this is continued for a shorter or longer period, according to the state of the weather and the quantity of grass. When weaned, the calves are turned into the best grass-fields, where, during the winter, they have a little hay and a good supply of turnips. The second winter, when they are about eighteen months old, they are put into a straw-yard, but their condition is fully maintained by an allowance of linseed cake, in weight about three pounds and a half daily; which, in value, amounts on the average to three-pence. This, for twenty weeks, causes an extra expense of thirty-five shillings a-head. The heifers have their first calf when about three years old, and the second when under four years of age. About a month prior to this period some of them are sold; but the greater part are retained until heavy with their third calf, when they are sold to purchasers who buy for the London cow-keepers. By this system, fully attended to, they attain their highest value in the hands of the breeders, and make a very considerable return for the expense and trouble incurred in bringing them to perfection; and the breed is thus kept up, and in a progressive state of improvement. It is, however, proper to state, that some of the forwardest and largest of the heifers have a calf at two years old.

The steers are raised and maintained in the same way as the heifer calves; but as they advance in age, having only to support themselves, and not an embryo progeny, they will do with more and coarser straw. They are not, however, merely kept alive through the winter season, their growth is not permitted to be checked or their condition to be lost. If turnips cannot be spared for them, they have also a portion of linseed cake; and though not more than a ton weight is allowed for half-a-dozen steers, yet that small quantity given to them regularly, at an expense below thirty shillings per head, has the effect of increasing their appetite for straw, and fully encouraging their growth and condition. Thus the expense is remunerated by the value of the beasts in ordinary seasons, and when prices are stationary; and the increased worth of the manure is amply proved by the very high state of fertility and general luxuriance of the crops at Wauldby. The cake is given to the cattle in troughs or cribs placed in the farm-yards. It has generally been applied to the fattening of cattle solely, and the plan of giving it to the young ones, which are

called "store cattle," is new, but the benefit is evidently great; and it occasions a much smaller quantity of turnips to be drawn for the farm-yards than would otherwise be requisite to keep so large a stock of horned cattle in such high and improving condition.

The steers are sold in the spring; when they have fully attained the age of three years, they go from the farm-yard in a state to fit them for immediate fattening on the rich pastures of ancient grass-land, with which Holderness and the east coast of Lincolnshire abound. A grazier possessed of good judgment will give from ten to twenty per cent. more for cattle of this high breed, than for those of equal age, size and weight, of the original Holderness kind, on account of the increased propensity to quick fattening, which is always evinced by the improved short-horns.

The system that has been described is, perhaps, as nearly perfect as the nature of the soil can admit of. Yet, upon the more elevated and exposed parts of The Wolds this could not be carried on to any great extent with advantage, in consequence of the total inattention that has been paid to preserving and improving permanent grass-lands; a certain portion of which is absolutely requisite for breeding cattle with success. In no situation, however, can a large quantity of corn be grown, or a large flock of sheep be maintained in the most advantageous manner, without a mixture of horned cattle. Where the breeding of cattle is ineligible from the absence of old grass-land, and the insecure state of the fences, it would be found good management to introduce two or three-year old heifers from the west coast of Scotland and its adjacent isles. This system is also practised at Wauldby. These cattle are exceedingly sound and hardy in constitution, and of great aptitude to get fat, even on the most moderate keep. Being indulged with a few turnips, or a small quantity of linseed cake, in the straw-yards, they improve greatly during the winter season; and their light weight and quiet and unroving disposition admirably fit them for such pastures as are usually allotted to sheep in these districts. By annual purchases at the fairs held at York, Malton, and other places where Highland heifers are offered for sale in the autumn, a stock of these may be kept up with advantage; selling one-half of them after the winter is passed, when they are always in much demand; and retaining the other half to graze with the sheep. It is a singular, but well-known fact, that whilst the steers of this breed of cattle are difficult to restrain in their pastures, and show a wild and rambling disposition, the heifers are exceedingly quiet and tractable, and rarely attempt to break through the slightest fence. On this account they are peculiarly suited for a Wold farm; and yet they are much more rarely found on such lands than they are in Holderness, or on the western side of the East Riding.

Draught oxen are not much used upon the Wolds; but after a lapse of years they have been again recently introduced at Wauldby; and there is no doubt but they will thoroughly establish themselves as an useful and profitable aid in all heavy work. The decline that has taken place in their numbers can only be attributed to the great demand and consequent high prices that were given for horses during the late war. This encouraged all farmers to become breeders of them. As many mares were, therefore, kept for this purpose as possible; and the number of them was increased because the work of the farm had to be performed by them whilst in a state of pregnancy, or when relaxed by nursing their foals. Many that were bred also proving blemished, or otherwise unsaleable, were retained for agricultural purposes, and thus no room was left for the employment of oxen.

But a great change has taken place. The demand for the army has happily ceased to be of much importance. Steam-navigation has already put down a very large number of coaches; and the introduction of rail-roads and locomotive engines, modern as they are, begin to be seriously felt by reducing the call for horses. These very circumstances, by decreasing the market for them, may, for a short period, encourage the use of horses in agriculture; but ultimately the tendency will be to check the breeding of them, and oxen will then be called in to supply the deficiency. All extremes ought to be avoided; and oxen as draught animals are valuable only for certain portions of work. Their slower pace renders them less eligible than horses for the plough, where the soil is light, and expedition of greater moment than strength; and this will apply to a large description of harrowing, &c; but they are admirable in the team for drawing manure and carting heavy burdens. At this work, in a hilly country, and where the roads are deep, they are fully equal to horses, are maintained at much smaller cost, require less manual labour and attention, and are infinitely more valuable in the end. The best method is to break them in at two years old, and to work them so moderately as not to injure their growth. The two following years they will endure much labour, and continue to grow and improve greatly; and at five years old they fatten most readily, and afford beef of the finest quality.

The formation of the foot of the ox is evidently not well adapted for much travelling over stony roads without protection; as the shoeing them is, however, a troublesome operation, and not generally performed without casting the animal, it is desirable to avoid it as long as possible. A steer, therefore, should not be shod as long as he can be used without indicating lameness. No stranger has traversed the Highlands of Scotland without observing how wonderfully habit enables the body to overcome the difficulties of situation: the soles of the feet, which, with us, are so tender as to cause us to flinch when we tread, without the protection of a shoe-sole, upon the slightest inequality, become by use so firm and hardened that even the women and girls run heedlessly barefoot over the sharpest roads. When the business of the farm will not admit of giving rest to the oxen, and they become tender in their feet with too much use on stony roads, they must then be shod.

The Messrs. Watson use the collar for the ox in preference to the old-fashioned yoke, and consider it preferable. For ploughing and harrowing it is perhaps so, as it has no tendency to bow down the head and neck, and the animal walks at greater ease and in his natural position. But he can certainly draw a greater weight with the ancient yoke, simple as it is in its construction and clumsy in its appearance. The pole-cart, which is called a "wain," is an admirable and economical draught for heavy work, such as carting manure, earth, stone, &c. Two oxen are "yoked" in this by a bolt passing through the pole, to prevent the yoke from slipping over the end of it.

PIGS.

These have been less attended to at Wauldby than any of the before-mentioned descriptions of live stock, the Messrs. Watson not having been in the habit of breeding them. Considerable numbers are, however, purchased to glean the stubble fields, and feed on the scattered corn, and also to keep in the farm-yards, where they do great service by constantly working among the straw, hastening its decomposition, and improving the quality of the manure. These pigs are usually purchased at about the age

of six months, and sold again when they have been retained four or six months. The improvement in their growth and condition usually makes a satisfactory return for their keep during that period. In the summer season they have tares given to them in the farm-yard.

WATER.

This first necessary of life is, by the bounty of Providence, so generally supplied through this kingdom that we are apt to overlook or undervalue the blessing we enjoy. Fine streams of the purest water gush from the chalk rocks in numerous places at the edge of the Wolds; but the elevated districts are not refreshed with streams, and springs upon them are rare. It is recorded by Henry Strickland, Esq., in his Agricultural Survey of the East Riding, that at Huggate upon the Wolds a well has been sunk in the chalk rock to the depth of 348 feet, without cutting through it or meeting with any other substance, except occasionally a thin stratum of flint. In many other places, too, it has been found necessary to cut to a prodigious depth before water could be obtained; but once reaching it the supply is never known to fail. The difficulty in obtaining water is, however, a serious inconvenience, and is, perhaps, one principal cause why we see so few horned cattle in this district.

The ingenuity of man is capable of overcoming great obstacles; and Mr. Strickland, in the work above alluded to, pays a just tribute to the memory of Robert Gardiner, a labouring man, who invented and formed artificial drinking ponds for cattle, which have since got into general use, and proved of the most essential service. For this purpose a situation is selected where the undulating ground admits a fall for rain-water from two or three directions, and, if possible, where the angles of four fields meet, for the purpose of extending its usefulness as far as circumstances will admit. The best conductor of water, in this very porous soil, is a road, which being made of chalkstone becomes cemented together by use, and does not admit it to pass through; consequently a moderate shower will collect much water where the fall is considerable in height and distance. The most eligible situation having been determined upon, a circle is drawn of sixty feet in diameter, from within which the soil is carted off. An excavation is then made in the chalk rock, formed in the shape of a shallow basin, regularly descending from the edges to the centre, where it should be seven feet in depth. The surface of this excavation is then made smooth by the inequalities being well broken and carefully raked over. It is then beaten down until it has been rendered perfectly smooth and even. A coat of newly-slacked and well-sifted lime is next spread over it to the thickness of one inch, which is instantly sprinkled with water to make it adhere well to its place, and any parts which seem insufficiently covered are spread over again. On this lime a bed of well-tempered clay is directly laid, which has been previously brought to the side of the pond. The clay is laid about six inches in depth, and very well and equally beaten down with wooden mallets as it is wheeled in. During this process it is necessary to use water to keep the clay in proper temper for beating it into a solid mass, and without cracks, for upon this the success mainly depends. When this is completed the clay is thinly covered over with straw, to prevent the stone that is now to be laid upon it from cutting into the clay. The whole surface is then to be made secure by a quantity of the chalkstone that has been excavated from it, and broken small, being wheeled in, and laid equally over it to the depth of eight or ten inches. It is requisite that the

whole of this should be done with great accuracy and neatness, and perfect attention to keeping the level.

This work ought to be done in the winter, all water being kept out of the pond until it is finished; and then the sooner it is filled the better the prospect of success, though it is advisable not to allow cattle to approach it until it has had two or three months to settle. The pond will be readily filled by the first rain, if proper channels have been made along the sides of the fences, or in other suitable directions for collecting the water as it descends the hills; and so large a surface will be considerably aided by the rains and dews that actually fall into it. So admirably are these ponds found to answer the purpose that seldom is there a summer so dry as not to afford a good supply of pure wholesome water for the cattle that frequent them. The small channels that convey the water should, however, be frequently cleaned out from grass, and any inequalities that may be made by the cattle approaching to the pond should be filled up, though this latter is rarely needed from the regular access afforded to all parts of it.

Before these reservoirs were constructed there was only one pond in the township of Wauldby, which was situated at the bottom of the fold-yards, and which was, as before stated, both the receptacle for all the filth which drained from them, and the drinking place for the cattle. Whether such very impure water is unwholesome for them or not, has perhaps not yet been ascertained; that they soon become habituated to take it is certain, and also that they then appear to prefer it to pure mountain-streams. It has also been considered as dubious by many experienced flock-masters, whether water is at any period advantageous to sheep; but it would seem that, however small the quantity they take, the relish is agreeable to them, from the avidity with which they run to it in hot seasons, and when the pastures are much scorched up. They will not take water unless tolerably clear, and always reject a foul pond. It is evident that, until a supply of water was obtained, the general dispersion of cattle over the pastures was out of the question; constant access to it is indispensable to them; they cannot thrive without it; neither can they be restrained from breaking over fences in hot weather when they are deprived of it.

The formation, then, of these reservoirs has proved an era in the agriculture of the Wolds; and the subject has been enlarged upon, because it is believed that there are many parts of England which would be greatly benefited by them, and in which they would be readily formed, if the mode of constructing them, and the unfailing supply of pure water which they afford, was perfectly understood. The expense will vary according to the price given for labour, the value of lime, and the distance from which the clay or tenacious earth may have to be carted to the pond. It is usual to allow two chaldrons of lime, and the labour, exclusive of the draught work, will here amount to about ten pounds. If used for more than one field it will also require fencing across by strong well-made bars, with feet to support them, and substantially coupled together, as of course nothing must be cut or driven into the bottom of the pond. Those made of iron, and well painted, are decidedly the best, and in a few years are found to be the cheapest. It is a work which ought to be executed by the proprietors rather than by the occupiers of the soil, as it is a permanent improvement and not liable to injury.

LABOUR.

The difficulty which is so generally experienced in providing employment for the labouring class of society is here unknown. From the care

that has been taken for many years past to employ young men of industrious habits and good character only as hired servants at Wauldby, an influx of idle paupers have been prevented from obtaining settlements in the township; and those who have done it have been taught that their comforts were solely dependent *upon the exertions of themselves and their families*. They have never had their energies damped by the difficulty which is experienced in too many places of finding work, or an ample remuneration for executing it. The interests of the employer and the employed have always been directly and intimately combined. The whole of the small township being in one occupation, there have been no sordid farmers keeping back employment for labourers until they were forced upon them by the overseers of the poor, when they are taken at a fixed rate, so low as to be utterly inadequate to the maintenance of themselves and their families. It is a system of this nature that has no doubt occasioned, in great measure, the alarming increase of poor-rates and of insubordination, and that decrease of industry and economy so universally and so justly complained of throughout the agricultural districts.

The married have comfortable cottages upon the estate, to which are attached gardens of sufficient size for culinary purposes, and to aid in the keeping of a pig. They are not on a larger scale, lest they should be the cause of abstracting their occupiers from the general work of the farm, and which is always found amply sufficient to employ them. Labour is provided not only for the men, but also for their wives and children, at all periods of the year, when the state of the weather will permit. They gather stones from the arable lands for the roads, hoe and weed both the corn and the turnips; assist in the harvest, and in the pulling turnips for cattle, and dragging them for the sheep; in getting stacks from the yard into the barn, and in removing the straw when the thrashing machine is at work.

It is the custom here to *let* the work as much as possible to labourers by the piece or acre, and thus to stimulate them to make the best use of their time. The wages given are very liberal, the men making from twelve to fifteen shillings per week, and the women being allowed one shilling a day both in winter and summer. During the harvest the women have one shilling and sixpence per day, and their dinner. These are much higher wages than are paid usually upon the Wolds, or other parts of the East Riding of Yorkshire, and at first view they may appear to be almost extravagant. In reality, however, such conduct is as judicious as it is liberal; it affords a strong stimulus to labour, and thus encourages good habits. When workmen are ill paid, the quantity executed is small, and in general it is performed in a very indifferent and slovenly manner. The amount, too, of poor's rate, will always be found in great measure to be governed by the rate of wages; and no doubt can be entertained but that it is most conducive both to the interest and the comfort of the farmer and the labourer, to have the former reduced to the lowest scale, though at a very considerable advance upon the latter.

MANURE.

To obtain a regular succession of productive crops, it is well known that the farmer's attention must be paid to a great variety of objects; but if any one branch demands more attention than another upon the Wolds, it is that of producing and procuring the largest possible supply of manure, improving its quality to the greatest extent, and applying it in the most profitable manner. The old, and even yet but too general plan of throwing straw from the barn in large quantities to a very small number of cattle,

and trusting to their treading it, with the addition of moisture only for its decomposition, is wasteful and ruinous. Rotted straw, without a full mixture of animal manure, possesses but little power to aid the vegetation of plants. The value of farm-yard manure will be always found proportionate to the quantity and quality of food which has passed through the stomachs of the animals that have been maintained in or about it.

There is no subject in which the opinions of theoretical and practical men are at greater variance than upon the management and application of manure. When about twenty years ago it was announced that the lectures of Sir Humphry Davy on Agricultural Chemistry were about to be published, they were looked for with eagerness, not only by men of science, but by a vast number of practical farmers. The price of a handsome quarto volume—two guineas—checked its circulation; but had the same work been then printed in a cheap form for eight or ten shillings, it would have yielded a large profit to the publishers, and widely diffused knowledge to that class of men who would have benefited themselves and the public by its attainment.

Sir Humphry was a most decided advocate for preserving manure as much as possible from fermentation, by keeping it in a dry state, and thereby preventing its decomposition before it is put into the soil. Yet even he admits, that "a slight incipient fermentation is undoubtedly of use in the dung-hill, for by means of it a disposition is brought on in the woody fibre to decay and dissolve when it is carried to the land or ploughed into the soil, and woody fibre is always in great excess in the refuse of the farm."

But what appears most perfect in theory is not always admissible in practice. It is of much importance to promote a vigorous growth in the early stages of the vegetable tribe; and this vigour is most certainly obtained by the use of farm-yard manure, after it has undergone the process of fermentation, and is thereby partly decomposed. Beside this, there are but few crops to which the long litter recently brought from a farm-yard can be applied, without impediment to the needful operations of harrowing and hoeing. In potatoe husbandry it may be effectually used, and generally is so, without any detriment to the after process. But even in the cultivation of turnips, on one-bent ridges, which comes the nearest to this, it is by no means uncommon, in spite of the best skill of the workman who manages the drill, to find numerous vacancies occur in the lines, in consequence of the long particles of manure becoming entangled with the coulter of the implement, and thereby dragging the seed into clusters. Very long manure also acts unfavourably to vegetation, in a mechanical point of view, in dry seasons, by rendering the land more porous and open to the admission of both sun and wind. And, again, it is invariably seen that the turnip fly, and other depredators of the grub species, are always most active upon those lands that have been covered with long litter. All writers on this subject concur in opinion, that manure ought, as much as possible, to be excluded from the atmosphere; and Sir Humphry Davy considers this a most essential matter; but practical farmers know that it is impossible, generally speaking, to effect this, unless it has been previously decomposed. When spread upon the land in the state in which it is usually brought from the farm-yard, it is incapable of being so minutely divided as to be buried in the soil by the plough; in this state, the great bulk of it remains exposed to view, and, consequently, to all the mischief of exhalation. These observations apply equally to it when laid upon grass land: short manure may readily be

brushed among the grass roots, but what is laid on in a recent state from the farm yard, must remain at the top until its decomposition has taken place.

Upon the whole, it appears to be the best method, to take the manure from the farm yards at convenient seasons, to spread it equally upon a foundation of soil that has previously been prepared on a level site for the purpose, and to bank up the sides so as to make the least exposure to the atmosphere. As soon as this is finished, the top should be covered over with another coat of soil, and the sun can have no effect upon it. By this means the fertilizing properties of the manure are fully preserved, and the quantity is augmented by the soil which has been laid under and upon it, for this becomes so impregnated by it, as to be of almost equal value.

Under the head of "Cattle," it has been observed, that at Wauldby those which are confined during the winter in the straw fold, are allowed from one to two hundred weight of linseed cake per head: this proves a great advantage to the manure, as well as to the cattle. It induces them to eat a larger quantity of straw, and improves the contents of the fold yard much, by promoting immediate fermentation. The Messrs. Watson are of opinion, that when this takes place to such a degree as to bring the manure into a manageable state,—that is, into such a state as that it can be covered by the plough,—it is desirable at once to draw it upon the fallows. This is practised as far as circumstances will admit, and is considered most beneficial, but it cannot be done to a great extent.

SOOT

Is a valuable top dressing for the wheat crops upon the Wolds, on which it is sown by the hand, in the month of February. The quantity applied is about twenty-four bushels to the acre; the price of it at Hull averages from four to five shillings per quarter.

CHALKING.

The vegetation of England is slow in comparison with that of the south of Europe. But the ingenuity and industry of man has been exercised to a degree which is unknown in more favoured climes; and Providence has in a wonderful manner enabled us to overcome the apparent difficulties of situation, and provided for us the means of improvement. This is perhaps peculiarly remarkable throughout the East Riding of Yorkshire. Our wet soils are usually capable of drainage,—our barren sands lie upon beds of marl,—and our wolds, which were thought, only half a century back, to be out of reach of all amelioration, are found to possess within themselves advantages which were totally unknown.

The beneficial result of marling or claying the barren, sandy, and moory soils has been proved by long experience; and the practice of it has got much into use in the western part of this division. But it is only a recent discovery, that chalk may be applied to the deeper and less fertile parts of the wold land with equal advantage. Mr. Strickland observes, in his Agricultural Survey of the East Riding, that "Chalk has been applied with singular advantage, and to considerable extent as a manure, upon the Lincolnshire Wolds, and is *coming* into use in this Riding. It is laid on in the winter, or early in the spring, that it may be mellowed by the frost, and at the rate of about 40 or 50 two-horse cart loads per acre, and is most beneficially applied to grass which is intended to be broken up for corn, or to land which is preparing for turnips."

This practice, which was then, twenty years ago, *coming* into use, has been carried on to a considerable extent at Wauldby, where the good effects of it have been amply proved. A pit has been opened where the chalk is supposed to be the softest and most free from flint, and convenient for application. This is dug up with pickaxes, and in a rough state carted upon the land, at the rate of from sixty to eighty cubic yards per acre. The expense is certainly far beyond what the generality of tenants would be justified in encountering, and few have the ability to withdraw such a sum from their capital as to carry on this improvement on a large scale. To proprietors who can advance the money for the work, it would be a great source of benefit, in which their tenants would amply share, though charged a full per centage for the original cost. It has been observed, that it is upon the "deep lands" that chalk renders the most essential service; that is, upon the land where there is the greatest depth of soil. To a stranger these would appear to be the richest and most productive parts of the Wolds; but such is not the case. Corn does not yield so well, neither does it ripen so soon as where the soil is shallower; and it is land unsuitable for turnips and barley; indeed, the former do not frequently plant well upon it; and when they rise freely out of the ground, and look vigorous for a time, they are almost invariably attacked by a disease called "fingers and toes." Instead of forming one round and perfect bulb, the root throws out a number of irregular and curiously-shaped excrescences; these contain a small white worm or grub, the leaves fall down in the heat of the sun, and the worthless plant quickly decays. Whether the insects found in the misshapen roots are the cause or the effect of the disease, is unknown; but however subject the land may be to this unnatural production, it is observed, that after it has been well covered with chalk, the turnips which are grown upon it are perfectly good and healthy, and entirely free from "fingers and toes."

BONES.

Under the article of turnips these have been already mentioned as greatly promoting the growth of that valuable plant. It was observed, that for the Swedish turnip, from fourteen to sixteen bushels were drilled upon the acre, in addition to a good dressing of farm-yard manure. Also, that a compost was usually formed for the extensive crops of white turnips, at the rate of fourteen bushels of half-inch bones, forty-five bushels of Hull ashes, and twenty-five bushels of vegetable ashes per acre. About four years ago much pains were taken by a public-spirited committee of the Doncaster Agricultural Association, to ascertain from the best sources what were the real advantages arising from the use of bones as a manure, the best mode of application, and the soils on which the most favourable results had been experienced. A valuable report was drawn up by the committee, which was published by Ridgway, Piccadilly, in 1829: this is highly deserving the attention of all agriculturists. The summary deduced from the replies to their extensive and well-directed queries is thus expressed:—

"1. On dry sands, limestone, chalk, light loams, and peat, bones are a highly valuable manure.

"2. They may be laid on grass with great good effect.

"3. On arable lands they may be laid on fallow for turnips, or used for any of the subsequent crops.

"4. That the best method of using them when broadcast is previously to mix them up with earth, dung, or other manures, and let them lie to ferment.

" 5. That if used alone, they may either be drilled with the seed, or sown broadcast.

" 6. That bones which have undergone the process of fermentation are decidedly superior to those which have not done so.

" 7. That the quantity should be about twenty-five bushels of dust, or forty bushels of large, increasing the quantity, if the land be impoverished.

" 8. That upon clays and heavy loams, it does not yet appear that bones will answer."

The quantity here stated is much more considerable than that which is given at Wauldby; but it will be observed, that it is there used in addition to other manures, and applied solely to the turnip crop.

It seems now to be a well-established fact, that upon all light and dry soils, bones may be used with much advantage; that they may be used for all crops with benefit, and that a compost formed with them is highly profitable for grass-land. It, however, appears that their use is most beneficial to the turnip cultivation, and that for this crop upon such soils, twenty-four bushels per acre are fully equal to twenty-four tons of farm-yard manure. How much the success of grain-crops is dependent upon securing a full crop of turnips is well known to all farmers situate upon a turnip soil; and it is also well known that this description of land is most abundant in elevated districts that are usually the most remote from towns and navigable rivers. In such situations the cultivator has been necessarily excluded from the aid of all bulky manures, which might be purchased in more favourable places, on account of the great expense of carriage. Here then we come to the vast advantage of ground bones, one load of these being equal in value for the turnip-crop to twenty loads of farm-yard manure.

The Messrs. Watson have purchased their bones extensively from Hull and Barton; the price has usually been about 2*s.* per bushel for those denominated "half inch with dust," that is, none to exceed half an inch in length, and the bulk to contain the powder which has been made in grinding them. Latterly, however, the price has increased with the demand; and for such bones, 2*s.* 6*d.* has often been obtained. There is a general prejudice against imported bones, and those collected at home have been much preferred on account of their freshness; but the Messrs. Watson, whose very extensive use of both, whose attention to effects, and great accuracy of judgment, entitle their opinion to the highest credit, do not think the bones which are imported from the Continent, and are in a very bleached state, at all inferior to those more recently collected.

APPENDIX.

SWANLAND FARM.

The Reporter of "Farming at Wauldby" cannot omit here to notice a beautiful farm of about 200 acres, which is the property of the Messrs. Watson, and cultivated by them. This extends close to the river Humber; it is a productive soil, lying upon the chalk rock universal in the Wolds, of which this farm is the extreme southern boundary. The *general* management of the Swanland Farm is so perfectly similar to that of Wauldby, that it would be a repetition to go over it. The whole of this was, a few years ago, part of an extensive open field, which had been in constant tillage time immemorial, under an unvarying course of three grain crops and a summer fallow. The good quality of the land, and its situation on the turnpike-road, within six miles of Hull, where manure is to be obtained in any quantity, had, however, preserved it from extreme exhaustion. The lands, as is too frequently the case in open fields, had been ploughed to a considerable height, and in consequence, the furrows between them were deep, and difficult to clear from weeds. These have been levelled, the whole has been divided into convenient inclosures, and the young quickwood-fences are rapidly getting up, having been kept perfectly free from weeds. An extra dressing of manure on the lands adjoining the fences is found most materially to promote their growth, and the expense is abundantly repaid by the perfection of the fences.

The farm-buildings, which have been recently erected in a centrical situation, are substantial, and extremely convenient, forming an admirable combination of neatness with economy. But the particular object in noticing this farm is to lay before the public a most successful attempt to form permanent grass-land in the shortest period, and upon the best principle. This has been effected by sowing grasses, valuable in themselves, and properly adapted to the soil on which they were to be grown.

It has been already stated, that the land was a strong friable loam, on a chalk rock; that it had been long in an arable state, and that the ridges of the lands had been raised to a great height; these were levelled, and the whole made perfectly clean, on a field which contained twenty acres. After having borne a crop of turnips, the field was sown with barley; and the following quantity of grass-seeds were procured from, and recommended by the celebrated Mr. Sinclair, late of Woburn, whose long and indefatigable attention to the culture of grasses has justly gained him the respect of all agriculturists.

18 Bushels	Dactylis glomerata -	Round-headed cock's-foot.
5 ,,	Lolium perenne - -	Perennial rye-grass.
4 ,,	Festuca pratensis -	Meadow fescue.
2 ,,	Alopecurus pratensis -	Meadow fox-tail.
5 Pecks	Trifolium pratense perenne	Perennial red clover,

2½ Pecks	Cynosurus cristatus -	Crested dog's-tail.
2½ "	Phleum pratense - -	Meadow cat's-tail.
2 "	Poa trivialis - - -	Common meadow-grass.
1 "	Agrostis stolonifera -	Fiorin creeping bent.
160 Pounds	Trifolium repens - -	White clover.
10 "	Achillea millefolium -	Yarrow.
10 "	Anthoxanthum odoratum -	Sweet-scented vernal-grass.

The judicious selection of these grasses is evident from the full, luxuriant, and well-matted sward that has been procured in three years. No coarse tufts or unsightly seed-stems appear in the pasture; it presents to the eye a beautiful verdure, and the appearance of the fat cattle and sheep which graze in it evince the nutritious properties of the herbage.

FARMING AT RIDGEMONT,

THE

ESTATE OF SIR T. A. CLIFFORD CONSTABLE, Bart., M.P.

IN THE OCCUPATION OF MR. WILLIAM STICKNEY.

COMMUNICATED BY MR. CHARLES HOWARD, MELBOURNE, YORK.

CONTENTS.

INTRODUCTION.

It has been the object of the reporter to give a general view of the present state of the agriculture of the East Riding of Yorkshire, by communicating an account of the mode of management adopted upon three farms; selecting one from each of the three great natural divisions of the district. Two of these have been already laid before the public. Scoreby, which occupies the fifth number of the reports of Select Farms, published under the sanction of the Society for the Diffusion of Useful Knowledge, details the best management of land in the western division. Wauldby, which is contained in the sixth number of the same work, explains the practice of an admirably well cultivated farm in the chalk district, called the Wolds. The present number is intended to complete this cursory review of the East Riding, by a report of a farm situated in the centre of the fertile division called Holderness.

This extensive tract of country is of a triangular form, bonnded on the east for thirty miles by the German Ocean—on the south for twenty-five miles by the great river Humber—and on the west, about twenty miles, by the chalk district described in the Wauldby Report. The town and port of Kingston-upon-Hull are situated at the south-western extremity; and the northern point extends nearly to Bridlington. Holderness contains about 270,000 acres of land, the quality of which may be termed uniform; and it is a remarkable circumstance, that in so large a tract there is scarcely a single acre that can be considered waste land. The soil is generally strong, more especially to the south and westward, and well suited for the growth of wheat and beans. There is a greater extent, also, of good old grass land in Holderness, than in any other part of the East Riding. It is usually considered a very flat country; but, perhaps, this is not quite correct, for although it is low, yet its surface is undulating. It

has soffered much from the imperfection of drainage, though of late years this has been greatly improved; and it will be forther considerably benefited by a drain of great magnitode, now forming under the sole management and superintendence of Mr. Stickney, the occupier of the farm at Ridgemont aboot to be described. This drain commences two miles to the north of Brandesburton, and empties itself into the river Humber, about the same distance east of the town of Holl; and will extend its benefit over 60,000 acres of land, which, though extremely fertile, have been hitherto of an uncertain value on account of their liability to be flooded.

RIDGEMONT

is situate in the parish of Burtswick and constabulary of Burton Pidsea. It is ten miles from Holl, eighteen from Beverley, and four miles from Hedon. It contains 840 acres of very valuable land, of a uniform quality, and in a ring-fence; but a part of it lies so low as to be subject to inconvenience in wet seasons from the imperfection of drainage. It forms a part of the very extensive estates of Sir Clifford Constable, Bart., M.P., who possesses the seigniority of Holderness, and a noble mansion at Borton Constable, a few miles to the east of Ridgemont. The hoose, which is an excellent one, and very considerably above the common class of farm-houses in appearance, was rebuilt a few years ago, chiefly at the expense of the landlord; but the greatest part of the very nomerous farm-boildings, and several excellent cottages aroond them, have been erected by the tenants. Having been boilt at different periods, and for the purpose of supplying the demand most urgent at the time, they present no uniform plan, though they afford every reqoisite convenience for the housing and accommodation of a very large number of cattle of every description;—threshing and straw-cutting machinery on a large scale;—horse-mills, carpenter's and smith's shops, and a variety of sheds and chambers for carriages and implements of husbandry. Indeed, they form a little town of usefol boildings, replete with every convenience for the occupation of so large and productive a farm. The fold-yards are nomerous, and upon a scale commensurate with the homestead; a drain is laid through them, leading to a copioos covered well, into which it conveys the urine. A pump is fixed into this well, and the contents are, at suitable times, again carted back to the folds and spread over the dry sorface litter; thereby rapidly promoting its more entire decomposition, and at the same time greatly augmenting the value of the manure. Mr. Stickney has carefolly observed the effects of this liquid manure both upon grass and arable land, when spread from a water-cart with a box affixed to it, in the manner that is usually adopted for watering roads; and he is decidedly of opinion that its most valoable application is to return it back to the manure. Of course this is chiefly done in the spring and sommer months, when the contents of the folds are in the driest state; and it may perhaps be needless to mention that, under this process, scorched or as it is termed 'fire-fanged' manure, is here unknown. Altogether, this farm-stead exhibits a degree of neatness, order and good management, exceedingly pleasing to the eye of a scientific farmer, such as is rarely witnessed in the hands of a tenant, and not often to be found even on the premises of a proprietor.

TENURE.

This farm is held only from year to year; a mode of occupancy apparently most insecure for the protection of a spirited agriculturist, and unfavourable to the promotion of extensive improvements. Yet experience

does not generally warrant such a conclusion; for investigation proves, that the oldest tenants, and most permanent occupations, are found upon the estates of many aristocratic families, who never let upon any other terms than from year to year. Such a degree of interest happily binds the landlords to their tenants, and the tenants to their landlords, that changes rarely occur beyond those caused by mortality. On the decease of a tenant, the name of the widow, or of the son, as may be arranged by the parties, fills up the blank in the rent-roll; and if there be no direct successor, a successful application is usually made for the farm by the next of kin. So much of the old feudal system yet remains among the higher ranks of society in Britain, that it would be considered discreditable to turn off an old tenant from an estate, unless misconduct, or an absolute necessity, compelled a change; and in the latter case he is not usually cast destitute upon the world.

The old custom of a mere parole agreement for a stipulated rent, and certain services of 'boon days,' are, however, gone by; and new leases for a year, and from year to year, are generally entered into, which stipulate not for the payment of rent and taxes alone, but contain clauses for regulating the course of cultivation, for directing a certain quantity of land to be annually sown down with clover or grass-seeds, for one, two, or three years' pasture; and for restricting the ploughing up or converting into tillage any of the ancient grass-lands; as also for keeping the buildings and fences in proper condition and repair. Such leases are to be found upon all the best-regulated estates, and if they are drawn up with judgment, and founded upon a knowledge of the qualities of the soil, they are alike advantageous to the proprietor and the occupier. These observations are justified in the instance of the farm now under notice: it has been occupied by Mr. Stickney and his ancestors for more than a century, and its high condition and general neatness are alike creditable to the proprietor, to his land-agent, and to the tenant.

IMPLEMENTS.

The tenacious clay soil of which this farm generally consists, not only renders it necessary to employ more varied implements of husbandry than are requisite for lighter lands, but it also requires them to be formed of very considerable strength; much pains have, however, been taken to give strength, with as little addition of weight and clumsiness of shape as is practicable. The waggons, which are here, as well as in other parts of the East Riding, much used, are well formed, with side-boards fixed on the top of the body, equally adapted for the carrying of corn in the straw or in sacks, and so light as not to be in any degree objectionable. The front wheels are only about forty inches in height, which enables them to pass under the body of the waggon, and thereby admits of its being turned in a space of ground little exceeding its own total length; in this there is much convenience and additional safety, and none of that breakage takes place which often occurs from bad drivers 'locking' a waggon. It is drawn by two horses abreast, with a pole in the coach fashion, as described in the reports already given of other parts of the East Riding. The plough is also used in the same manner, with two horses abreast; though, if the soil is wet, they are generally employed, and with more advantage, in line, one before the other, when taking up the furrows between the lands; as the treading and poaching of the ploughed soil is thereby avoided. In addition to the common plough, Mr. Stickney possesses a most valuable one for the purpose of clearing out the furrows between the ridges, after the wheat crop has been sown and harrowed in; or, indeed, at any other period,

when it is necessary to have the land as dry as possible. The manner in which be procured this implement shall be given in his own words. 'I saw an account in an agricultural publication of a millwright going to visit a farmer.* The farmer complained to him of the difficulty he had long experienced, in his strong and retentive soils, of clearing out his furrows between one land and another, of tbe clods and the crumbs of soil which fell back again after the operation of the common plough, and thereby obstrncted the proper discharge of the water from his land. This statement excited my attention, for I had long experienced the same difficulty. The millwright requested tbe farmer to take a spade, and put a portion of the furrow exactly in tbe position he would wish the whole to be in;—he did so—and the millwright soon produced an implement which performed tbe operation in a very expeditious and complete manner. I stated this circumstance to the Holderness Agricultural Society, one object of which is to introduce implements or machinery from a distance, of which we may have a good character, but which are unknown in onr own neighbourhood. It was ordered by the society, tried by the members, and found to answer the character given of it; and it is now in the hands of many farmers in the Holderness district. I would not be witbout it for many times its cost, and I consider it to have greatly benefited my farm.' This implement, called by Mr. Stickney the 'boat-plough,' is not over-rated in value. It is so admirably constructed as to leave the land exactly in the form in whicb a good farmer would wish it to be laid; making a clear and distinct drain, with the smallest possible loss of land. It is drawn by two horses in line, both walking in the furrow. It is difficult to describe, because we have no other plough which bears the smallest resemblance to it; its form is that of a small boat cut off from gunwale to keel, six feet distance from the head. It is partly decked in the front. The keel, shod with iron, is five feet in length; and the extreme widtb of tbe planking is three feet eight inches, though the top is contracted to five feet two inches. The height of the side is two feet two inches, having a curve of three inches with its concavity outwards. The hales and beam resemble those of a common plough, the former are six feet ten inches, and the latter seven feet ten inches in length. Farmers, not within economical reach of the inventor, might procure the implement from 'Mr. William Stamford, millwright, Burton Pidsea, near Hedon,' who has made them for Mr. Stickney and others; the price is supposed to be about 3*l.* 10*s.* delivered at Hull; and it sbould be accompanied by the simple sledge which Mr. Stickney uses for removing it from one field to another. This plough has been particularly noticed, because the reporter is of opinion tbat it is valuable and but little known; and that if its merits were understood it would soon be used in all the clay districts in the kingdom. Mr. Stickney has had a similar one made upon a larger scale, to wbich he attaches four horscs, for tbe purpose of forming the surface-drains ('grips') across the ridges, which it cffects in the same excellent manner and to a very considerable deptb. A man follows with a tool, for the purpose of spreading the mold raised on the sides equally over the land.

It may not be improper here to note the eligible plan practised by tbe Holderness Agricultural Society with regard to such implements as, upon particular recommendation, they purchase for trial. They are retained for one year, for tbe purpose of lending to such members in rotation as may desire to try them; and after that period, they are put up for sale by auction of the members. By this means they are dispersed over the country, and

* Farmer's Magazine, vol. vi. p. 200, contains the history of this plough, which was invented by the ingenious Mr. Gladstone of Castle Douglas, N. B.

no valuable implement is allowed to remain buried, until it is forgotten, among an accumulation of such as have proved worthless or unsuitable to the district.

The drill machines chiefly in use at Ridgemont are those called 'Perkin's drill,' and the cup drills, which latter have now become very general in the county, and are calculated for sowing hand manures, such as bones, rape dust, &c., with the different species of grain when required,—a practice becoming very prevalent here. The Dutch hoe, called in Holderness the 'shim,' is much used, and several varieties are kept at Ridgemont. They are formed considerably stronger and heavier than those usually seen in gardens, and the front of the share is angular. Those intended for the nine inch intervals have a share only six inches in width, but the total length of the iron work from the extremity of the point to that of the square socket for the shaft, is two feet in length. The shaft is about five feet ten inches in length. Those of wider dimensions, but of a similar form, are employed for crops cultivated at a greater distance between the rows; but if the interval be more than twelve inches, Mr. Stickney prefers the 'horse shims,' which are attached to a pair of wheels about three feet in diameter, and usually hoe two rows at a time.

The dibble is a heavy iron rod two inches in circumference; the plummet at the extremity, which forms the hole or seed-bed, being of an oval shape, about the size of a small pullet's egg, and not brought to a very fine or sharp end; the handle is of wood, and resembles that of a gardener's spade: total length two feet nine inches.

FENCES.

These on the higher grounds are uniformly of quickwood, planted level with the soil, and on one side defended by a drain from three to five feet in width, varying as circumstances may require. The usual distance at which the plants are set from each other is four inches, and perhaps this is the best distance; allowing sufficient room for growth, and yet not leaving an unnecessary space. Mr. Stickney, however, observing the greater luxuriance which they exhibited when allowed more room, has planted some so wide as nine inches apart; and in this method he has certainly succeeded in raising very strong and efficient fences in a short space of time. It is, however, much to be doubted whether this plan would be found to be generally advantageous, where only a common degree of pains is bestowed in the cleaning and cultivation of the plants during the early period of their growth. On inferior soils it seems necessary to plant sufficiently close to prevent even the smallest animal that grazes in a field from making its way between the stems: for upon such land it is in vain to hope that the branches will be so vigorous as to oppose resistance; for which purpose, the stems alone can be depended upon. The quickwood most esteemed is that which has grown two years in the seed-bed before transplanting, and two years in the nursery afterwards. Before placing them in the line of the fence, the tops are cut off, permitting the extremity only just to appear above the soil; and if the plants are cut down again after they have made one year's growth, it is observed that they not only put out more shoots from the bottom, but that they grow with greater vigour. Thus there is no loss of time by this process in forming a fence, which is thereby ultimately thickened and strengthened at the bottom, where strength is peculiarly required. In the course of years also, when it becomes necessary to renew the hedge by cutting it down, it is of much advantage to have a choice of stems; as in this case some may be cut close to the ground, and

others one or two feet above it; so that while an abundance of young wood is obtained from the very bottom, there is yet so much of the old wuod left as to render the whole again impenetrable after the growth of two summers. It is the practice at Ridgemont to keep the fences low adjoining the arable fields; but tall unes are valued for the division of the pastured grass paddocks around the homestead.

The general aspect of Holderness is naked; the only woods of consequence in the district being those at Burton Constable, and on the estate of Richard Betbell, Esq., M.P. at Rise; smaller ones are seen at Winestead, and on Mr. Constable's beautiful estate at Wassand: but in hedge-row timber, which is the chief ornament of a low country, this district is peculiarly wanting. It is much to be regretted that the planting uf forest-trees in the hedge-rows should have been so entirely neglected. This indifference has probably arisen from situation; for being much exposed to the cold easterly winds from the German Ocean, which prevail for a long time in the spring, the trees have not been found to flourish so luxuriantly as they do in more sheltered districts. It may also be partly attributed to the injudicious preference of the ash. This is decidedly the worst and most injurious tree that can be cultivated for hedge-row timber, as it not only extends its roots laterally to a very great distance, and has the habit of growing them almost on the very surface of the earth, thereby draining that nutriment from the soil which should be applied for supporting the crops; but the droppings from its leaves appear to have a bad effect upun plants growing within their influence. This is evinced by the failure of crops cultivated near the ash, and by their luxuriance where from the intervention of a deep drain, or from other causes, its roots cannot spread. Besides which, beautiful and useful as the ash really is, and justly as it is the pride and boast of the northern counties of England, it is neither adapted for a bleak exposure nor a clay soil: in such situations it is usually seen only in a sickly or stag-headed state. It may be fairly presumed that the oak, the sycamore, and the chestnut, would grow with greater luxuriance, and be less injurious to the crops beneath their shade. The climate would also be improved to a considerable extent by planting them, as well as the country beautified.

In the lower grounds, the subdivision of the fields is formed by ditches or drains of from eight to twelve feet in width; a very considerable sacrifice of ground, but not to be regretted on account of the drainage thus afforded. It is probable, however, that even here a narrower drain would equally suffice, and that living hedges would be found tu afford a most beneficial shelter; more especially as these lands are much employed as pastures.

FALLOWS.

Though many eminent agriculturists have altogether condemned the practice of summer falluwing, yet experience generally proves that even the most skilful and attentive farmers on strong soils cannot keep their land in good tilth and clean order without the occasiunal intervention of a full and naked summer fallow. Such is the case at Ridgemont, where it occurs generally in the fifth or sixth year; though sometimes, when the seasons have been favourable for cleaning the drilled crops, it is extended to the seventh year. This process commences by ploughing the stubbles to a full depth as early in November as possible, that is, as soon as the wheat crops have been got into the ground, when the teams are at leisure for this work. As soon as a field is ploughed, the requisite watercourses across the lands, called '*grips*,' are formed by the boat-ploughs, and the furrows

between them are cleaned out in the same manner. Thus the land is kept dry through the winter, and derives the full advantage of the frost and change of seasons. In this state it remains until the spring crops have been sown, and the horses are again at liberty to proceed with the work. As the tenacious nature of this soil prevents it from working into very small particles, the heavy harrows, such as Finlayson's, and other powerful drags, are considered to be more efficacious in cleaning the land than the plough, and are therefore more used. It is, however, very necessary where the clay soil gets overworked and much pulverized, to permit it to rest so long as to combine again; for if the wheat be sown when in this state, and the land harrows extremely fine, the following wet season will certainly cause the earth to run together and set upon the surface like a beaten floor of clay, almost impervious to air and water. Under such circumstances it is in vain to hope for a productive crop; the only measure that can be adopted to give vigour to the root, is to attempt to raise the mould again by very free hoeing and harrowing, as early in the spring as the land becomes sufficiently dry to bear the treading of the horses, without their feet sinking into the earth. The extremes, of great unbroken lumps of clay, and that fine state of pulverization just alluded to, must be carefully avoided.

The summer fallows are generally manured in one course, and limed in the next, thus taking it in turn; so that lime is not employed to any extent more than once in ten or twelve years. The quantity given, upon these occasions, is from three and a half to four chaldrons per acre; and it is thought desirable not only to lay it upon the land before it has become at all saturated with water, but as soon as possible after it has fallen, and as early in the season as circumstances will admit: a practice much to be applauded. There is another application of lime in small quantities, for the destruction of the snail tribe and other insects, that will be hereafter alluded to. In the alternate fallows, when manure is to be used, it is brought into the field and neatly heaped up, at any time when the state of the weather and the leisure of the teams render it most convenient. This removal from the fold-yards generally commences during the winter, if there is any length of frosty weather; and is indeed necessary for the accommodation of the live stock contained in them. It also promotes the decomposition of the manure, and facilitates the laying it upon the land; but this latter operation does not take place until the fallowing is completed, and the manure is only spread upon the land just prior to the last ploughing, when it is taken up for the seed furrow.

Whether an earlier application of the manure would not, on the whole, be more advantageous, may be a subject deserving inquiry. Though it has been carted previously into the fields where it is required to be used, yet in a wet autumn and retarded harvest the act of laying it on the land must occupy considerable time; and as not less than from ten to twelve tons are allowed to the acre, the land must be liable to be much poached by this operation, and considerable delay take place in sowing the wheat. Besides which, however good the condition of the manure, and with whatever accuracy it may be spread, it cannot get thoroughly mixed and incorporated with the soil for the early use of the crop. It is also obvious, that if the manure be not much decomposed, it must necessarily harrow to the surface, and prove an impediment to the coulters of the drill when the seed is deposited.

The soil upon this farm is for the most part decidedly too tenacious to render the cultivation of green crops on fallow lands advantageous; all therefore that can be done to avoid the heavy sacrifice of an unproductive

year, or at least to prevent its recurrence more frequently than absolute necessity compels, is to make general use of the drill; and to take advantage of all seasons when the state of the crops admits, to ameliorate the land and destroy the weeds, by the free employment of the horse and hand hoes. This has long been an object of much attention here; and Mr. Stickney certainly avails himself of the full benefit of the row system of cultivation. His mode of management evinces that he is equally aware of the loss that must arise from the payment of rent and taxes for land which is lying dormant under an unproductive fallow, and that arising from the failure of crops sown on exhausted soils.

COURSES OF CROPPING.

Summer fallow—manured freely.
Wheat—drilled and well hoed, or '*shimmed*,' or both. *See page* 133.
Red clover—mown, and slightly limed afterwards to destroy grubs, &c.
Wheat—on one ploughing, drilled and hoed.
Beans—dibbled and '*shimmed*.'

SECOND COURSE.

Summer fallow—limed.
Wheat—drilled, hoed, and sown with grass seeds.
Pasture.
Pasture.
Oats—sown on a single ploughing.
Beans—hoed and '*shimmed*' as before.

THIRD COURSE.

Summer fallow—manured.
Wheat—drilled.
Red clover—mown.
Beans—dibbled.
Wheat—drilled.
Oats—sown after a single ploughing.
Beans—dibbled, and kept clean by the shims and hoes.

The above is the usual mode of cultivating the arable lands of Ridgemont; but the courses are not so rigidly adhered to as not to be varied by seasons, or other circumstances, which point out the propriety of occasional deviation. They tend, however, to show what is pretty generally the case; that in eighteen years the summer fallow occurs three times; that of wheat five crops are produced; of beans, four crops; and of oats, two crops. Also, that in that period red clover is sown twice for the purpose of being mown for hay, and that the land obtains two years' rest in the state of pasture. It will be observed, too, that the fallow is preferred to be made after the bean crop.

It has been stated that this farm contains about 840 acres, but as there are about 240 acres in grass, the arable lands will not much exceed 600 acres. According to the routine, therefore, above-mentioned, it will appear that the summer fallow amounts to 100 acres annually; that the wheat crop occupies about 168 acres, and the beans 134 acres; and that the oats, red clover, and grass leys, are nearly equal in quantity,—there being about 66 acres left for each.

The principal variations that occur are the occasional introduction of peas or tares in the place of beans, and sometimes that of rape. It is however always an object so to regulate the crops as to equalize as much as

possible the quantity of produce, and the quantity of work that will be required to be performed.

WHEAT.

This is the most important crop which is grown at Ridgemont; the land is naturally adapted for it, and though grown, as shown in the preceding account of the courses of cropping, no less frequently than five times in eighteen years, it is the one that is perhaps least liable to fail. Neither does it appear that this constant repetition has any tendency to lessen the produce, for the quantity threshed usually amounts to between 650 and 700 quarters. An accurate account, kept by Mr. Stickney, of the produce of different fields, proves that the grain is somewhat most productive when sown upon the fallowed land; next to this, after red clover, upon a single ploughing; and then after the beans, which have been dibbled and kept clean by the 'shims' and hoes. But upon these three preparations the produce seems pretty equal, and the variation that is perceptible may perhaps arise as much from season and the condition of the soil, as from the crop or preparation that has preceded it. The mode of preparing the summer fallows has been fully stated; and it is thought desirable to complete these as early as possible; but the most favourable period for sowing the grain is considered to be from the middle of October to the 10th of November. However clean the soil may have been made, it is so addicted to the production of 'black grass' (Alopecurus agrestis), that the crop is greatly injured thereby if sown early in October; though among later-sown grain this weed makes but little progress. In addition to this evil, it is found by experience, that by a rapid and early vegetation of the wheat, the tillering branches of the young plant are apt to exhaust themselves, and lose their vigor before the spring arrives; and consequently the plant is not then in a state to throw out so many and such vigorous shoots as are necessary to make a full and yielding crop.

The land having been harrowed about a fortnight or three weeks after the last ploughing of the summer fallow, the seed is prepared for the drill by mixing very minutely, in its dry state, one ounce and a half of finely-powdered arsenic with each bushel of wheat. This Mr. Stickney considers the most efficacious of all remedies to prevent the production of smut and truck in all their varieties. The cost is trifling, as it does not exceed a penny an acre; but great caution is requisite to mix it extremely well; and afterwards to clean very carefully the sacks, and all places which can have been affected by it. Objections have been made to the use of a poison of so powerful a nature; and among others it has been stated to be particularly fatal to game and poultry that pick the seeds up from the land. Mr. Stickney does not, however, find that even when sown near the farm-stead, and much gathered by the poultry, that they appear to suffer from it; and he is of opinion that the proportion which is used is too small to occasion injury to them in the quantity of grain that they are able to consume. He admits, however, that it would be unsafe to use it in this dry state if sown by hand out of the hopper, as in the broad-cast mode, for then the small dust might prove injurious to the sower of the grain by being inhaled, and would, in the course of time, affect the eyes, the nostrils, and the mouth. He has repeatedly used the common applications of salt and chamberlye, sprinkling the grain afterwards with quick-lime, and derived advantage therefrom; he has also tried, with success, the use of vinegar, as a preventive of smut; but he is decidedly in favour of arsenic, as being the most certain and least expensive remedy. It is effected with little trouble, and

in good and careful hands may perhaps be preferred to the other modes, but so much risk and danger attend its general use among careless and ignorant people, that the practice ought scarcely to be encouraged; and, in the dry state, as was already observed, it can only be used with safety and advantage when the grain is intended to be deposited in the soil by a drilling machine.

The drill is now brought into the field, the coulters are set nine inches apart, and the boxes so regulated as to sow ten pecks upon the acre. The seed is placed about two inches deep in the ground, and a slight harrowing is given after the drill. The land being sown, and the seed properly covered in, the large boat-plough, described at page 132, is drawn by four horses in such lines, obliquely, or across the ridges, as the situation of the ground may require, to carry off the surface water. These channels, 'grips,' are usually made solely by the spade, but this mode is equally or more advantageous, and the work is effected in one-tenth part of the time, always an object of the first importance, both as regards expense and benefit in farming operations. The smaller boat-plough is then passed down every furrow between the lands, and thus a perfect drainage is effected. In this state the crop remains during the winter; but as soon as the soil begins to dry, in the month of March, the 'shims,' described under the head of 'Implements,' are brought into action, and the intervals between the rows of corn are all cleaned, and the weeds eradicated by them. This hand-spittling is upon the whole thought more eligible than horse-hoeing, as the implement can pass nearer to the plants, without danger of cutting them up. The general mode of using the shim at Ridgemont is by pushing it forward in a straight line, and not taking it out of the ground, and walking backward, as in the common method with gardeners. This straight-forward manner facilitates the work considerably, and can be effected for 2*s.* or 2*s.* 6*d.* an acre. When the land is in good order, an able workman will shim nearly six roods a day, though one acre may be considered an average day's work. The shim raises the mould from a greater depth, and more effectually than the hoe can do; but as it simply cuts the roots of the weeds, some of them will remain alive. A short time, therefore, after this has been done the hoe is introduced, and the whole of the intervals are hoed; and if any weeds grow in the wheat lines they are drawn out by the hand.

There is no doubt but this careful culture has a great tendency to encourage the strength of the plant, and thus increase the quantity and improve the quality of the grain, by rendering it 'bolder,' more plump, and free from the seeds of weeds; and it cannot pass unnoticed that the land is thereby kept in greater vigour, and in a cleaner state for the succeeding crop. The process of cultivation as thus described on fallow lands, is pursued in the same manner when the wheat has been sown on clover ley, or upon a bean-stubble,—but on these the quantity of seed allowed is greater by a peck per acre; indeed, it is not unusual, when the seed is put into the ground in a late or unfavourable season, upon such lands, to sow as large a quantity as three bushels to the acre.

Though a good crop of wheat is generally obtained here after red-clover upon a single ploughing, yet it is not unfrequent to break up grass seeds that have been pastured two or three years, at Midsummer. In this case, the land is generally ploughed three times, and very well harrowed, so that, in fact, it becomes fallowed land; to which the not inappropriate term of 'afternoon fallow' is given.

There is a practice at Ridgemont which may be worthy of general imita-

tion,—it is that of spreading in dry weather, and *during the night*, a small quantity of lime in a very quick and hot state, though reduced to a fine powder, upon the land which has borne clover or beans, a few days before it is ploughed. The express purpose of this is to destroy the various species of the grub and snail tribe that are found so frequently to injure the wheat crop. With this intention, from twenty to thirty bushels per acre are applied; and Mr. Stickney, who has paid much attention to the subject, is fully convinced that the most beneficial result is occasioned by the practice; he now suffers little from the depredations of slugs and the small grey snail, though before he commenced this plan he had suffered so much in his wheat crops after clover that he had almost abandoned that otherwise advantageous course of husbandry. The lime is thrown up from the carts high into the air, in order to spread it more equally over the land, where it is allowed to remain a few days undisturbed. These slimy-coated insects are all abroad in the night, and the pungent dust falling upon them is certain destruction; but its effect upon the wire-worm is not nearly so powerful.

When the period of harvest arrives about one-half of the crop is reaped with the sickle, and the other half mown with the scythe. Those crops that are the heaviest, and most laid, are cut with the former implement,—and the others with the latter. Each plan of reaping has its advocates: but the progressively increasing use of the scythe is a strong evidence of its superiority,—corn is probably gained by it, and certainly more straw. In wet seasons, too, it is observed that mown corn suffers less in the stack than that which has been shorn; not being so close and compact in the sheaf, the air is admitted more freely, in consequence of which it is generally in a state to lead into the stack or barn a day or two sooner, which is an object of much importance. Those farmers who contend for the sickle say that the operation is performed in a neater manner by it; that the work of threshing is less difficult, and therefore the grain is more completely beaten out; that the grain itself is brighter in colour, as no clods of earth can be incorporated with it, which it sometimes happens get into the sheaves by the use of the rake when the corn is mown; and lastly, that the higher stubble which is thereby left in the field is never without its value, as, when ploughed in, it renders the soil more light and friable, and where clover or grass seeds have been sown, it affords them a degree of shelter that greatly encourages their vigour, protects them during the winter, and promotes their early vegetation in the spring. The price given for shearing wheat is from 10*s.* to 15*s.* per acre, the average may be 12*s.*; for mowing it, the charge varies from 7*s.* to 12*s.*, the average may be stated at 9*s.*,—this includes the binding, stacking, and raking the land afterwards to gather the scattered ears. The cost varies according to the state of the crop and the supply of hands; vast numbers of labourers find work here at this season who come from the western coast of Ireland; and there is no doubt but these men cause a greater quantity of grain to be cut by the sickle than would otherwise be the case; they are content to shear at a moderate price, but are generally unacquainted with the use of the scythe, and unprovided with the instrument. If it were more the custom to let them the work by the 'threave' (twelve sheaves) instead of paying them by the acre, the farmer would benefit by it, as in that case the corn would be cut lower, nearer the ground, and consequently cleaner, and the evils of large sheaves and tight binding would be obviated.

In the stack-yard a number of sites are raised, for the erection of corn stacks, a little above the natural soil, that the stacks may be kept dry at

the bottom; these sites are about twelve yards in length and four in width, and in the centre of the length a channel is formed to admit the air to pass entirely under the stack. As soon as the grain and straw are considered to be sufficiently dry they are brought to the stack-yard, and if the season is unfavourable, or the corn not very dry, a tunnel is formed by placing a wooden pipe, about twelve feet in length and nine inches in diameter, exactly over the centre of the air-channel before-mentioned. This pipe is gradually and perpendicularly drawn up as the stack advances in height, so that a complete air-chimney may be formed to the top, and thus a free current of air passes under the bottom and through the centre of the stack. The plan is good; in wet seasons very serviceable to all crops, but generally of the most essential advantage to stacks of oats and barley. It may, however, be questioned whether it does not give increased facility to the access of those destructive vermin, rats and mice. To get these stacks thatched as soon as possible after they are formed is an object of much anxiety; to the full as much attention is paid to putting them into neat and trim order as economy will justify. Here the stacks are only rounded a little at the ends, and are properly built with an even top, which is best calculated to carry off the water; but it is too common in Holderness to waste much time in forming large stacks of a fanciful form, raised at the ends and sunk in the centre. Such forms always admit the rain, unless extra pains be taken in thatching; and when the stacks are too large to admit of being taken into the barn at once, considerable waste of grain, or of time in securing the remnant, must occur.

The varieties of wheat grown here are numerous, but the Boswell Red has long been in great estimation. It is now, however, giving place to what is called 'Creeping wheat:' perhaps it has acquired this name from the tendency it possesses to tiller much; that is, to throw out many branches in the spring. On this account it is held to be more productive than any other; yet it is decidedly weaker in the straw, does not form a handsome head, nor look so well upon the land. Considerable quantities of the Talavera wheat are also grown; and it is much liked by the millers, as it yields a full quantity of very white and fine flour. For late autumn, or for spring sowing, it is perhaps preferable to any, from the rapidity of its early growth. It perfects its seed, too, in a short time, and, when sown at the same period with other wheats, it is always the first to ripen. But in unfavourable harvests, its tendency to sprout proves a serious evil; and it is not unfrequently spoiled from that circumstance, when slower growing wheats are scarcely injured.

BEANS.

The grain crop next in importance at Ridgemont to the wheat, is beans, the culture of which has rather increased of late years, and the mode of it is entirely changed. Few years have elapsed since all the beans in Holderness were sown broadcast, and no attention was paid to clearing them from weeds during the progress of their growth. This slovenly plan was broken into by the introduction of the drill, when, of course, the improved plan of hoeing commenced. This soon became pretty general throughout the district among all the best farmers. But now the drill is, for this species of grain, rapidly giving place to the dibble. Indeed, at Ridgemont the produce of dibbled beans has appeared to be so much greater than from those grown in any other manner, that it is only under particular circumstances, and when extraordinary despatch is necessary, that the drill is used for this crop. Beans are now principally sown upon a wheat or oat stubble,

though they used frequently to follow red clover. The practice of cultivating them upon fallowed land does not at all prevail here, though highly extolled in many counties, and, perhaps, it might be pursued even here with advantage.

The stubbles are ploughed as early in the winter as the season will permit; the first dry days in February are made available for harrowing the land, though this is done but slightly, so as not entirely to efface the plough seam. The holes are then made in rows by the dibble, either along the seam of every furrow of ten inches, and set a little more than five inches apart in the rows; or otherwise, in every alternate furrow; but in this latter case the beans are sown only three inches apart. Thus the same quantity of seed, two bushels per acre, is used in either case; the crop appears to be somewhat more productive in the ten inch intervals, which admit the bean to branch and spread equally on every side; but this excludes the use of the horse-shim, and causes a greater expense in cleaning the land; neither does it admit of its being so long and freely worked whilst the crop is growing. The dibbling is performed by one man walking backward with a dibble in each hand, which he presses forcibly down into the earth in the seam of the furrows, and thus forms the holes from two to three inches in depth; four droppers, generally two women and two children, follow him, each of whom carry a small basket of seed in the left hand, and with the right drop one seed into each hole. These form what is termed a set, and, if tolerably expert, and the circumstances favourable, they will dibble more than an acre in a day. The usual price paid at Ridgemont for this work is 6*s*. per acre. Immediately after planting, the land is harrowed with harrows rather heavy, but not having long teeth; were they otherwise, the seed might be disturbed from its bed. So soon as the beans are about an inch in height above the ground, the intervals are cleaned, and the soil is loosened by the shim; for which operation 2*s*. an acre is paid. This 'shimming' is generally repeated when the beans have advanced to six inches in height, soon after which they form a close and luxuriant shade, which effectually prevents the after-growth of weeds. When, however, the land is not tolerably clean to begin with, or is particularly rough and clotty, or the season proves unfavourable for destroying the weeds, instead of, or after the use of the shim a second time, the crop is hand-hoed; but the price of hoeing is nearly double that of shimming.

Beans certainly pod much better when not crowded together; and it is very material to the success of this crop that the seed be deposited not only in regular intervals, but at an equal and sufficient depth. This could not be accomplished by the old broadcast system, in which mode a considerable portion of the seed was always wasted by laying quite on the top of the land, or so near the surface as to be exposed after the first heavy shower of rain. Even the drill, on account of the great variation in the size of individual beans, could not deposit them at regular distances in the rows. In these respects, therefore, the dibble is a most decided improvement, and certainly more preferable for the bean than the wheat crops, to which it was long ago applied in Norfolk. When beans are sown in a tolerably clean field, have been properly hoed, and afford a full produce, the land is always found in a fine state after reaping them. The weeds have been then completely destroyed, and the fall of the bean leaf greatly assists in the melioration of the soil. It is the common horse-bean that is chiefly cultivated at Ridgemont, but sometimes the Mazagan are sown: they are shorter in the straw, but yield a good produce in grain, and ripen very early. It is on this latter account chiefly that they are sown, for the price which they obtain in the market is somewhat less than the others: they are, however,

chiefly used for the consumption of the farmstead. As these beans are larger than the horse-bean, nearly a bushel an acre more is used in dibbling.

This crop is either mown, or reaped with the bean-hook, at a cost of from 7*s.* to 10*s.* per acre. To admit the air more freely, they are set up in the field to dry, in 'shocks' of three sheaves only, the sheaves being tied with bands of wheat straw, and thus the waste which occurs by the shedding of the beans, when the straw thereof is twisted into bands, is avoided. The straw of beans is a good fodder, and cattle usually thrive upon it better than upon any other straw; but the crop is dependent, more than many others, upon the seasons, being often affected by insects and injured by blights. The produce, therefore, varies much: sometimes it is as low as two quarters per acre, whilst, at other times, as much as five quarters have been obtained. About twenty-eight bushels are considered to be a fair average return.

OATS.

The variety of oat that is chiefly grown here is the Tartarian, the produce of which, both in straw and in measure, is decidedly larger than any other, though perhaps, of all that are usually cultivated, it is the latest in ripening. On this account it is very material to have a pure and unmixed sample for seed, as the earlier oats ripen and scatter their best seeds upon the land before the Tartarians are ready to be cut.

The breadth of land sown with oats at Ridgemont is usually less than that of beans. They are chiefly cultivated after a grass ley, or upon a wheat stubble, and in either case they are sown upon a single ploughing. The quantity of seed used is from five to six bushels per acre, which are for the most part sown broadcast in the month of March, as soon as the beans have been got into the ground; indeed, sometimes before the Mazagan bean is dibbled. No attention is paid to them during their growth, unless any thistles or other large weeds should appear among them, which require to be eradicated by hand labour. Mr. Stickney does occasionally drill his oats upon a wheat stubble, but he is of opinion that less advantage arises from the use of that implement in the culture of this than of any other grain crop. They are generally cut with the scythe, at a cost, upon the average, of 8*s.* per acre.

BARLEY

is so little grown here, or, indeed, in any part of Holderness, that the naming of it might have been entirely omitted, if such omission of a crop so generally cultivated would not have been deemed an oversight. These strong soils are ill adapted for the growth of barley; for, although the produce may occasionally not be deficient in quantity, yet it is of so coarse a quality as to render it an unsaleable article to the maltsters, and even for the fattening of pigs it is not so much in demand as beans or grey peas. It is, however, observed, that when grass or clover seeds are sown with barley, they are less apt to fail, or be in any way injured, than when they are sown with other crops. This may partly arise from its being grown only upon those fields which are of the gentlest nature, and where the soil is most friable, or from greater pains being taken to bring the soil into that state of pulverization which is so necessary for the growth of the barley.

RAPE FOR SEED.

The soil of this district is well suited for the cultivation of rape, and it was formerly much grown, and considered to be a profitable crop at Ridgemont. There was, however, during that period a duty upon the importa-

tion of rape-seed, amounting to 10*l.* per last. Since that duty has been taken off, and the growers on the Continent have been allowed to compete with British farmers, there has been so great a reduction in the market price, that it has ceased to be an object of much importance, and is now only grown as an occasional crop. When sown, it is on land on which a winter and spring fallow has been made, and in the month of June or early in July half a peck of seed per acre is sown broadcast. Not much attention is bestowed upon the after-culture, though a little hoeing is sometimes found beneficial. If very luxuriant, even when intended for a seed crop, it is occasionally slightly pastured by lambs when first taken from the ewes; and if this be not carried to too great an extent, and the season is favourable for the purpose, no mischief arises from the practice.

It used to be threshed upon a floor-cloth in the field where it grew, and it was the common habit to burn the straw immediately afterwards. But at Ridgemont it is led to the homestead and threshed with the machine, and the straw and pulse are put into the farm-yards, picked over by the cattle, and the whole is converted by them, with the aid of the swine, into valuable manure; thus making a large addition to the contents of the yards. Four quarters per acre is esteemed a very good crop.

RED CLOVER.

Fourteen pounds per acre is the quantity usually sown of this seed. It is generally cultivated with the wheat crop, being sown broadcast as early in the month of April as the shimming and hoeing of the intervals have been completed. It is considered to vegetate more freely when sown with wheat that has been drilled, than with that which has been sown broadcast, because more mould is raised in this way than it is possible to effect in the latter mode. Consequently, when the seed is harrowed it is effectually covered. The young clover plants have also more space for growth in their early stage, which is a matter of much moment in securing a full crop. Though some of it is used for soiling, the great bulk of the clover is mown for hay, but little of the old grass swards being applied to that purpose. When the season is precarious for drying the clover hay, the excellent, though by no means general plan, in the East Riding of Yorkshire, of 'ruckling' is adopted: that is, forming the swathe into sheaves by twisting them round individually at the top, and setting them up singly by expanding the stalks at the bottom. In this way, clover will bear a considerable quantity of rain without much injury, and, when the weather is favourable, it is very soon dried, in consequence of the free access of air through it. The stacks of clover hay are made large, but they have always those air-tubes formed under aud through them which have been described at page 140.

GREEN CROPS.

No part of this farm being at all suitable for the cultivation of turnips of the common kind, it is rarely attempted to raise them. Swedes will grow to a good size even upon this strong soil; but though always a hazardous crop, they are doubly precarious here. Much pains are, however, taken to ensure a small quantity near to the homestead, and generally with success. Bones are not found to answer to the great extent which they do upon calcareous and lighter soils; though, when the season permits the land to be very finely worked, and reduced to moderate pulverization, the benefit of them is fully seen. The manure which appears here to be most universally efficacious in ensuring a crop of Swedes, is that which is procured from the town of Hull, and which is a mixture of night soil and household coal ashes.

This is either led from thence as back carriage on delivering corn, or brought by water to Hedon, and carted from thence. If this is not to be had, a very ample supply of the best farm-yard manure is allotted to the Swedes, which are invariably sown here upon one-bout ridges, according to what is termed the Northumberland method. This crop is usually drawn for the use of the ewes in the lambing season, being seldom cultivated to so great an extent as to furnish any great store for the horned cattle. A full supply is, however, raised for the draught horses in the stable during the late winter and early spring months. To these horses they are alike palatable and nutritious, and have a great tendency to keep their legs fine and their coats smooth: for this purpose they are always washed clean. To the ewes they are given upon grass-land, being previously sliced to prevent the breaking or injuring of their teeth.

CABBAGES

are also grown at Ridgemont, though not upon a large scale. The varieties cultivated are the old Scotch and drum-headed cabbage. They are given to the sheep upon grass, and a small quantity is frequently allotted to the yearling calves. They attain considerable size; but it is observed, that however highly the land may be manured for this produce or for Swedes, the corn crop after them never exhibits that degree of luxuriance which it does upon good soils of a lighter quality. This injury may arise partly from the necessity of reducing the soil to that high state of pulverization which is requisite for their early growth, and partly to the land being unavoidably much poached by carting off the crop.

RAPE FOR SHEEP.

Much excellent food is obtained for the flock during the months of August and September, by sowing a portion of the fallow land intended for wheat with rape or cole-seed, as early in the month of June as the land can be duly prepared. This is the only green crop to which this strong soil appears to be well adapted. It is sown broadcast, and has not much care bestowed upon it. But it is probable that the same advantage would arise here that has been found to result in other places from sowing this plant in wide intervals by means of the drill, and using the horse-hoe very freely. This materially promotes the vigour of its growth, and it is well known that a luxuriant plant of rape, with a thick stem, is what the sheep are most partial to, and on which they fatten with the greatest rapidity. Perhaps the most nutriment is contained in the pith of the stalk, for the sheep evidently prefer this to the leaves. If the weather proves tolerably dry whilst the sheep are upon the rape, not only do they thrive better, but the succeeding crop of wheat is improved; in wet seasons, when the land becomes poached by the feet of the sheep, the succeeding crop always suffers. Indeed, better crops of wheat are generally obtained at Ridgemont after a naked fallow than after it has had rape upon it eaten off by sheep.

POTATOES,

for the above reason, are not cultivated here to any great extent; a few only are grown for domestic purposes, and for the use of the pigs. The quantity produced per acre is not so large as it is on many inferior soils, and the succeeding crop always appears to have suffered very materially from this preparation. It is in vain to contend against the nature of the soil, and crops for which it is not naturally adapted can only be cultivated to a very limited extent.

GRASS LAND.

There are about two hundred and forty acres of this extensive farm in grass, though of this perhaps little more than one-fifth part can be correctly termed ancient grass land or permanent sward, as the bulk of it has been laid down, though at very different periods, and some of it many years ago, by the present tenant.

Every judicious farmer well knows the value of good grass pastures. Even with the best management, and upon those soils that are most calculated for the growth of clovers, and what are termed 'artificial grasses,' good old sward cannot be advantageously dispensed with. But the deficiency of this is most felt upon such soils as are chiefly calculated for the cultivation of wheat and beans, because upon these strong lands the success of clovers and grass leys is the least certain, being liable to be parched by drought, or starved by excess of moisture before their tender roots have been able fully to establish themselves in the earth. And again—on these soils in wet seasons, and especially during the first summer, the leys do not bear the treading of heavy cattle. Indeed, where breeding and grazing are united to any considerable extent with the cultivation of grain, as they always ought to be, it is impossible to carry the system forward with advantage on strong tenacious soils, without a full proportion of what is termed "old grass."

Several circumstances have united to reduce of late years the quantity of land in England of this description. The very high price which grain bore during the close of the last century, and the first twelve years of the present, rendered it a great object with farmers to raise as large a quantity as possible. The increased price of produce made farms eagerly sought after, and a general great advance of rents was the direct consequence. The amount of rent was, in fact, of little moment, when wheat was selling at 14*s.* per bushel, and other grain in proportion; and more especially if the occupier could stipulate, as he usually and often successfully attempted, to plough out a certain quantity of old grass land. On the termination of the war, the price of grain fell rapidly; rents could not be paid, and either they must be reduced, or some indulgences granted to enable tenants to meet them. A field of good grass, worth 36*s.* per acre in its then state, would grow heavy crops of oats for two years in succession without further expense than a single ploughing, and then perhaps rape or flax, and after it a crop of wheat. Neither proprietors nor occupiers could believe that the depression was more than temporary, and therefore the former were unwilling to commence a reduction of rent, which might not be bereafter necessary; and the latter were eager in urging permission to plough out more grass land, desirous of adopting an expedient which held out the double advantage of raising present money by a sale of live stock, and an increased quantity of grain at the smallest possible cost. Thus, unfortunately, as experience has since too amply proved, were the old grass lands on many estates converted into an arable state at a time when good policy would have guarded cautiously against the change.

The difficulties that attend laying down land to permanent pasture with a probability of success are known to every farmer, and it is only the most intelligent and spirited that ever make the attempt. White clover and Pacey's rye-grass are good as far as they go. To that great patron of agriculture, Mr. Coke, we have been indebted for an extended knowledge of the value of cocksfoot. From the same source we may trace, by the encouragement which he has given to those who have particularly directed

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good talents to rural affairs, our knowledge of Blakie's admirable system of "inoculation." In like manner, to the Duke of Bedford we probably owe the important information that has been given by Mr. Sinclair on grasses. Yet the practice of laying down land to good permanent grass has not been much attended to, and facts already established are still little known, and instances of success require to be published to promote the best plans, and encourage the advantages that arise from their adoption.

The intelligent occupier of this farm has the merit of having introduced a most valuable addition to our grasses, which has much extended itself by the name of "Stickney's rye-grass," the account of which may perhaps be best given in his own words. "About the year 1802 I commenced cultivating several sorts of grasses. Among them I found a variety of rye-grass to have merit beyond any other; this variety I had selected from some particularly rich-looking plants. I continued to extend the cultivation of it for several years. About the year 1806 I formed an opinion from observation, that some of our best pastures continue their richness and verdure without the grasses ever being re-produced from seed. The appearance of the little field in the front of the house of my friend Richard Brigham of Bilton led me to this conclusion: I had observed it to be always eaten very bare, and never knew any of it produce seed; I therefore concluded it must be stocked entirely with grasses of a permanent kind, and I had a good deal of curiosity to ascertain what they were. I obtained from my friend a sod about two feet square; I placed it in a situation where it had an opportunity of showing its seeds, and to my great surprise it proved to be, nearly without exception, that variety of rye-grass which I had been assiduously cultivating for five years. I extended its cultivation every year, continuing also to contrast it with the best purchased rye-grasses, and other grasses which I could procure, and it has always maintained a very great and decided superiority. I was rather apprehensive for some time that its merit might have consisted *in habit*, which it had acquired by soil or situation, or rather by the particular manner in which it had been treated (being always grazed), and that when it came to be cultivated like other rye-grass it might degenerate, but after many years' cultivation I do not find that this is perceptibly the case. From my observation of the superior merits of this grass in various situations, and from the favourable result of many experiments with it upon this farm, I am almost inclined to think that, with due attention to its culture, it will supersede the necessity of cultivating any other sort; for it appears to have almost every property which we want in grass—it is early—continues its verdure to the latest period—it is permanent—much relished by cattle of all descriptions—and abundant in produce. It has the property of forming a thick matted sward from the abundance of bottom grass which it continually puts out, and it grows freely at all seasons of the year, when the weather is mild."

It is the opinion of the reporter that Mr. Stickney has not overrated the value of this grass. He has seen it in a variety of situations, and at different ages and periods of growth. He has seen at Ridgemont pastures solely laid down with it of from eight to ten years' standing, which have really the close and matted verdure of old grass land. He has also tried it himself upon a small scale on light sandy land, where its amazing produce and excellent qualities are most fully shown. On the whole, it appears to be an invaluable grass for principal use in the formation of permanent pastures and meadow land, and it may also be sown with great advantage for temporary grass leys. The correctness of this opinion is in some measure confirmed by that of several of the most respectable and intelligent agri-

culturists in Holderness, who have expressed themselves decided advocates for it *. For the cultivation of this grass, Mr. Stickney had the honour to receive in 1826 the large silver medal from the Society of Arts.

SHEEP.

Holderness was formerly noted for a very large breed of sheep, which were covered with a heavy but remarkably coarse fleece. It would seem that size of carcass and weight of fleece had been the sole objects of attention, as these animals had little else to recommend them. They were extremely slow in laying on fat; and even in the rich pastures of this district the wedders were seldom ready for the butcher under two or three years of age. But the name of Bakewell had been some time before the public, and the early maturity—aptitude to fatten—fine, yet long wool—and perfect symmetry and smallness of bone of his sheep, became a common subject of discourse. There were not wanting men of sufficient intelligence in Holderness to see that his breed would form an admirable cross with the sheep of their own district, nor of spirit and enterprise to risk the trouble and expense of procuring rams from Leicestershire. The improvement exceeded their most sanguine expectations. It was exactly what was wanted—an improvement of breed, and not a change. The wool was still long, but much finer in quality; the sheep were still of ample size, but greatly amended in form; and so much was the propensity to grow and to fatten at an early age increased, that it was discovered that the wedders would nearly attain the weight in two years which they had formerly done in three. Here then was the formation of an invaluable breed of sheep, and the success that had been attained encouraged the attention of the owners, and great pains were taken, by judicious selection, to preserve a description of sheep so peculiarly calculated for the soil—uniting size, mutton, and wool.

At Ridgemont, about two hundred ewes of this kind are kept for a breeding stock. From these, fifty are annually drawn out, as soon as their milk is completely absorbed, and their udders drawn up, after weaning the lambs; they are turned into the best pasture to improve their condition, and they are then sold to other breeders, or fattened for the butcher. These are, of course, either the oldest ewes, or those which are the least perfect in form or in fleece; and when they are taken away from the ewe flock, the vacancy is filled up by a like number of the most choice and eligible gimmer shearings. A few of the best male lambs are retained by Mr. Stickney for the purpose of letting as rams, when a year and a half old; the remainder are castrated when about ten days old, and sold fat after they have been once shorn; that is to say, when they are one year and a half old. A few Swedish turnips or cabbages are always given upon grass land to the ewes in the lambing season; and at that period also, if they

* *Certificate.*—"We, the undersigned occupiers and cultivators of land in Holderness, have this day viewed several plots of land sowed at different periods of time by Mr. William Stickney in his farm at Ridgemont, with the particular grass seed cultivated by him. All the specimens show that the sward of this grass is more readily formed, and of much better quality, than that of any other grass with which we are acquainted. Whether in permanent pasture, or in seeding land, its superiority is sufficiently apparent.

(Signed)	" JOSEPH STORR.	JOHN COLLINS.
	" ROBERT BELL.	WILLIAM IVESON.
	" ROBERT STUBBING.	JOHN TAYLOR.
	" THOMAS DODDS.	RICHARD BRIGHAM.

" *Ridgemont, October* 2, 1817."

can be spared, to the fattening sheep; but, as it has been before observed, it is very difficult on these strong soils to raise any food for the sheep during the winter season, except grass and hay. It is not an unusual practice, however, to send the Holderness sheep, or rather lambs (in Yorkshire called hogs), to other parts of the riding to be wintered upon turnips, where the lighter nature of the soil is better adapted for their cultivation. The expense of this varies according to the abundance or scarcity of turnips; in some seasons the best may be obtained for 2*l.*, and in others they will be worth as much as 5*l.* per acre. But it is very common to send them to consume turnips by the week, the charge for which is from 3*d.* to 6*d.* per head per week. When the flock is large, the owner of the sheep generally sends his own shepherd to attend them, provided with nets for dividing the turnips into suitable folds, and an instrument for dragging up the half-eaten ones as occasion requires. The shepherd has usually board and lodging at the house of the farmer who grows the turnips.

There is little at Ridgemont to favour the sheep beyond the good grass pastures and grass leys, excepting rape grown upon fallow lands intended for wheat; and though this is admirable food as long as it lasts, it will be remembered that this crop can only be had recourse to during the months of August and September. On finishing the rape the wedders are usually sold, when the weight of the carcass will average about twenty-four pounds per quarter. Some are killed directly by the butchers, but many large sheep of this description are purchased by sheep dealers who buy turnips in other districts, on which they keep them until a later period to acquire still more fat, and then sell them again in smaller lots at Wakefield and other markets in the West Riding. The fleece, it has been observed, is heavy; and it is not unusual for these sheep to average seven pounds of wool.

Holderness thus affords specimens, and not rare ones, of a breed of sheep that can scarcely be excelled; indeed, the Wold farmers hire the greatest number of their rams from this district; but the soil is not calculated to carry them regularly through the winter. This deficiency renders it unfavourable for maintaining extensive flocks; consequently, we find them only in limited numbers, and secondary in importance to the horned cattle. That destructive disease, to which almost all low countries are liable, called the rot, is prevalent here in wet seasons; and in the autumn of 1830 the ravages it occasioned reduced the number of sheep to probably less than one-half of what had been previously kept in the district, and the blank is still visible.

CATTLE.

The old breed of Holderness cattle, like the original breed of Holderness sheep, has entirely disappeared. And here also the same judicious mode of improvement has been adopted, namely, crossing from the finest animals, that most nearly resembled their own in general appearance and character. The Teeswater cattle were to the Holderness precisely what the Leicester sheep were to those of the same district. The large, heavy, slow-fattening but deep-milking cows of this country have been crossed by procuring bulls from the very eminent breeders in the North. And yet it is not improbable that the great improvement in the breed which has taken place in these short horns originated on the borders of the district, from the great and skilful efforts of the resident families of Strickland and St. Quintin. Something may have been lost in size, and certainly in milk, by this cross; but much more has been gained in early maturity and aptitude to fatten. And it may be boldly asserted, that not only in size, but even in quantity

of milk, the loss is individual, not acreable—that is to say, that any given quantity of food will, upon a large scale, afford a greater quantity not of beef only, but of milk, from the improved than the original breed. Nor should it ever be forgotten, that this is the great principle that should direct all attempts in the improvement of sheep, of horned cattle, and of swine—the largest and most valuable produce raised and maintained at the least expense, and upon the smallest quantity of land. Perhaps of late years the improvement has not progressed in the same ratio which it did some time back, when the higher prices afforded a greater stimulus to breeders, and money was more plentiful among them; but, on the whole, the cattle are very good, and well suited to the soil.

About twelve cows are kept for the use of the house, the labourers, and the live stock which require milk at Ridgemont. Independent of the produce of these cows, a few of the best heifers are annually retained for the purpose of breeding calves, which they are allowed to suckle. The following year, when they have a second calf, some of the prime ones are brought into the cow stock to supply the place of old or inferior ones, which have been disposed of, and the remainder are sold as "in-calvers." In this manner about twenty calves are annually reared; they are generally dropped in the early winter or spring months, and those bred from the cows are usually retained in the calf-houses a considerable part of the summer, having a little old milk allowed them, in addition to such grass or other green food as the season affords. They are then turned for a time into "fog" (after-grass), and they are housed again in November, and live through the winter chiefly upon hay, but the two succeeding winters they pass in the straw-yard, and have little more allowed them. Mr. Stickney observes, that they thrive best when beans are threshing; and he states that their growth is considerably checked, and that the condition which they gain in the summer is lost, when they have only straw from wheat or oats. To the reporter it appears that very considerable loss must arise from the deficiency of good and nutritious food during the winter. This is, indeed, partly attributable to the unfitness of the land for the growth of turnips; but it might perhaps be advantageously supplied by the use of linseed cakes, upon the admirable system practised at Wauldby by the Messrs. Watson. Though the breed of cattle is good, they do not appear to excel, from the want of proper food at all seasons of the year. The steers are chiefly fattened on old grass land, being turned into the best grazing pastures in the spring, when they are fully three years old; and sold from thence about Michaelmas, having attained an average weight of about sixty-five stone.

These cattle, from their size, strength, and activity, are well calculated for draught, and perhaps in this respect inferior to none, excepting the Herefords, the Sussex, and the Devons; yet it is unusual to see oxen used for labour in Holderness. There seems to be a strong prejudice against them, which has probably arisen at a period when the breeding of horses was a more profitable engagement than it now is, or at any future time likely to become. Sound reasoning upon just and well-founded calculation might perhaps show the superiority of oxen in point of economy for one half of the farm labour in Holderness, and, by gradually increasing their use, remove the strong prejudices which both masters and servants entertain against them. It is not to be wondered at, that those who drive the team should prefer the high spirit and more noble appearance of the horse, though the ox accustomed to labour is found to be at least equally docile, and much stable work is saved, as well as a large quantity of corn.

HORSES.

The habit of using these animals exclusively for all farming operations, the strong nature of the soil, and the large quantity of grain threshed solely in the machine worked by them, require a considerable number of horses to be kept for these purposes. From sixteen to eighteen are generally employed on this farm; but the breeding of horses, though generally prevalent in Holderness, is little practised at Ridgemont. The rearing of them is considered to be attended with much risk and uncertainty, and subject, from a variety of causes, to more disappointments than occur in the breeding of other stock. It is also justly observed, that in wet seasons, and when the grass is luxuriant, their constant frolics in the pastures greatly waste the herbage, and that on this tenacious soil they are an unsuitable stock for temporary grass leys, the land being liable to be much poached by them. Excepting, therefore, that a foal is bred now and then from a favourite mare, such horses as may be required are purchased at two or three years of age; and, consequently, there is no great stock of them upon the farm, beyond the necessary supply for labour.

The mode of keeping them is somewhat peculiar; they are maintained chiefly in the stable, through the summer as well as the winter, and in the former the great bulk of their food is natural grass, though when the sources from which this supply is obtained fail, they are allowed clover or tares. A good practice prevails here of not allowing the sides of the roads to be pastured by cattle, as they are always apt to break fences in such situations, get into corn-fields, or wander about inconveniently. The sides of the roads have been laid tolerably even, and, as well as the margins of corn-fields and the banks of drains, are mown for the stable. This gives a peculiar air of neatness to the place, and prevents the spread of thistles and other seeding weeds; and it is considered that food of this description is more nutritious for draught horses, and that they stand their work better upon it than when they have clover or tares.

In the winter they are kept entirely upon cut meat; oats and beans in the straw are chiefly used for this purpose. A chopping-mill upon a considerable scale is worked by horses, and the cut food falls into a chamber adapted for its reception. This has long been practised at Ridgemont to a great extent, and much advantage is considered to result from it. It certainly admits of a great saving of hay, but it is evident that some waste will always arise from the horses throwing it out of the crib in search of the corn, which is liable to fall to the bottom, though this is endeavoured to be obviated by forming the cribs deep, and placing a few bars across the top of them. In addition to the corn in the straw, a pretty full supply is added, consisting chiefly of beans, which are half ground by a suitable mill, and then added to the cut food.

The draught horses are very powerful, and tolerably active, and clean in the legs; their colour is chiefly bay and brown or black; but the heavy black cart-horse of Lincolnshire and Derbyshire is not much in use here, nor indeed is it found generally in this district. The descriptions chiefly bred in Holderness are hunters, hackneys, coach horses, and between the latter and the heavy black, a useful kind of strong but lively draught horse.

PIGS.

From the quantity of grain that is raised upon this farm, and the great length and luxuriance of the straw, it is found absolutely necessary to keep a large number of swine in the fold yards at all seasons of the year for the purpose of breaking it, and promoting its decomposition. They are bred

upon the place; but there is nothing remarkable in their kind or their treatment. They are the common Yorkshire breed, improved by a cross of the Neapolitan pig; this cross has had the effect of reducing the bone and superfluity of coarse hair, and also of increasing the aptitude to fatten. The weight they acquire, when fattened at eighteen months old, is from eighteen to twenty-five stone of fourteen pounds.

The greater number of these pigs are, however, merely kept in store or growing condition, deriving a large portion of their food from the scattered grains in the straw, and the refuse from the stables and cattle-houses which surround the fold yards; but in the summer, clover or tares are given to them in addition. When at or under twelve months old, they are sold to be fattened in distilleries or in potato countries, where food suitable for the purpose is raised in greater abundance. Ten or twelve are annually killed for home consumption, and are fattened upon steamed potatoes and bean meal. For this purpose, and occasionally for the use of other animals, a boiling-house has been erected, and a very good, though not large, steaming apparatus is in use.

LABOUR AND FARM COTTAGES.

The ploughing and other manual work is here chiefly performed by labourers who reside upon the farm. About a dozen cottages have been erected near to the homestead, for the accommodation of these men and their families. These are extremely neat in their appearance, and afford a most satisfactory and pleasing instance of the comfortable manner in which many of the agricultural labourers in the East Riding live. Were any one accustomed only to see the filthy and crowded tenements in which the manufacturing population reside, either in towns or in the crowded villages in the districts of Leeds and Manchester, with their dirty walls and large heap of ashes accumulated before the door—to see the squalid appearance and tawdry ragged dress of that class of population—to hear the ribaldry and coarse language but too generally used, and too loudly repeated in such places,—were such an one to be suddenly put down before the neat cottages at Ridgemont, with their walls covered with neatly-trained useful fruit-trees, and ornamented with shrubs and flowers, he would seem to have been transported at once to a little paradise. It is, indeed, a most interesting scene; and there is a degree of order and appearance of comfort around these humble dwellings that is but too rarely witnessed, and which can hardly be excelled. The respectable appearance of these married labourers, the tidy dress of their wives and children, the air of comfort that is so strikingly prevalent both in their persons and their habitations, show how much may be effected by persevering attention and good example. Near to, but not in front of the cottages, are the gardens attached to each, and which consist separately of a rood of land. The management of these of course varies; some are cleaner and more productive than others; the more provident and best conditioned families take care to raise a good supply of fruit and the most useful vegetables, and appear to enjoy the luxury of a garden, whilst in others little more than potatoes are visible, yet all are in fair condition, and no waste ground is seen.

Great as must be the advantage to these families of being provided at a moderate cost with a considerable portion of food for themselves and their pigs, that is but a small part of the benefit resulting from the system. By insisting upon neatness in externals, and a propriety of conduct and decent behaviour, the children are trained up to good habits; and the work required to be done in these gardens at every leisure hour is highly conducive

to general industry, and the avoidance of bad or trifling habits. All these cottagers keep a pig; but only two of them, the blacksmith and the carpenter, are allowed the keep of a cow. They pay an adequate though moderate rent, from three to four guineas a year for the cottage and garden, and they receive liberal wages with constant employ. They have the advantage of enjoying a warm meal at noon with their families, instead of walking, as many do, two or three miles every morning to their work, provided only with an indifferent and cold dinner. Indeed, it must be obvious to every one that theirs is a situation of great comfort, and that either a noble principle of gratitude, or the mere fear of losing their place, must operate upon all in rendering them obliging, industrious, and valuable servants. How great the contrast between these men and that description of agricultural labourers but too generally and well known by the name of "row-men," men who are sent by the overseers of the poor in rotation to serve masters for whom they feel no particular interest, and who in turn receive them unwillingly, give their orders to them carelessly, and find that they will come at the latest, go at the earliest hour, and study to do no work in the interval which they can avoid! Such is the natural consequence of the system—such the inevitable result of the general administration of the poor-laws.

The greatest evil that can befall agricultural labourers is the non-residence of the landed proprietors, and next to that the division of large farms into small ones, and both these circumstances have of late years been much upon the increase. The more minutely farms are divided, the more is the required quantum of labourers decreased. It is only when men occupy land upon a large scale that we find any number of workmen in regular and constant employ. The rate of wages paid at Ridgemont is somewhat above the average of the East Riding; less than 2*s.* per day is rarely offered, and in many instances the yearly average is 2*s.* 6*d.* Women and children are paid in like proportion. But whenever the work to be performed is of a nature that admits of its being let, the practice is preferred both by the employer and the employed; more work is done in this manner in the same space of time, and children can thus frequently assist their parents in little matters, for which they could not be regularly engaged by the master for the day. Had Ridgemont been extra parochial, it is probable that a poor rate would have been unknown; but, coupled as it is with the parish of Burtswick, this is not the case. Not only does the rate amount to somewhere about two shillings in the pound upon the actual value of the property, but in the winter season some labourers are unable to meet with employment, and are sent about as "row-men," though this latter circumstance is not carried to great extent. A select vestry is held in the township, and the effect of it is considered to promote the better management of the poor.

DRAINING.

Holderness is so very low, that many parts of it would be subject to be flooded by the sea during the period of high tides, were it not that embankments have been made, and effectual cloughs placed at the mouth of the large drains, where they empty themselves into the river Humber. The great fall of the tide, however, and the undulating surface of the soil, combine to render the whole district not difficult, though somewhat expensive, to drain in the most perfect manner. Formerly, there were very extensive carrs and low places that were under water six months in the year, and, though the soil itself was good, they were quite incapable of cultivation,

and produced nothing but coarse aquatic grasses. Of this description of land a part of the farm of Ridgemont consists. The first great effort to effect a drainage of any considerable extent in Holderness was made about sixty years ago, when an act of parliament was obtained to cut a large drain through several of these low grounds into the river Hull. This, of course, facilitated also the drainage of the higher lands, and the improvement that was thus effected acted as a stimulus to the formation of other drains. Thus gradually has Holderness availed itself of all its natural advantages, and though it must ever be considered a low country, it cannot now be accounted a wet one. When the surface water is conveyed by proper channels from the low grounds they are rendered sufficiently dry, because they are free from springs; but in this undulating district much spring land is found on the rising grounds, though visible to the eye only at certain seasons of the year, and chiefly when it is under the plough. At these times, and especially during the early spring, it is observed that the soil dries partially, and that the earth in some places assumes a darker hue: this is always a proof of superabundant moisture, and affords a certainty of success from the skilful application of under-drains. At this period, too, the most exact lines may be traced for placing the drains to the greatest advantage, thus making the most extensive improvement at the smallest expense; and without great attention to this, not only is much money unavoidably wasted, but a consequent disappointment is incurred, alike disheartening to the owner and the occupier of the estate. Wherever springs exist the bad effects are evident, when the land is in grass, from the coarseness of the herbage, which is less relished by cattle, and of course less barely eaten than the drier parts; and when the land is under corn the crop is generally lighter, and always later in ripening. Such parts of a field are also usually less free from weeds, especially such as propagate chiefly by the root, it being scarcely possible to eradicate or destroy these effectually while the land remains in this state. And all these effects are visible, even when the quantity of additional moisture is not so great as to render the land sensibly softer, and by no means to an extent that can be termed bog.

It is only of late years that the benefit of under-drains on this sort of land, called here 'half-wet,' has been at all understood; but it is now found to be so considerable, that the practice is rapidly extending over Holderness. A certain quantity of tiles are usually allowed by the landlord, and the tenant never hesitates to lead them, whatever may be his distance from the manufactory, and to incur the expense of cutting the drains and laying them down. Indeed, though the improvement is permanent, this portion of the cost is very frequently repaid by the increased produce of the two first crops. A little of this work is done every year at Ridgemont, and the mode is exactly similar to that which has been recently described in the Report of 'Farming at Scoreby.' Although, where the land is very level, an advantage usually arises in forming single and straight drains at equal distances along the field, to fall separately into an open drain, yet, on the sides of hills, and where the spring is irregular and partial, this is by no means the case. The drains are here cut as the spring itself may direct, and generally it is found best to cut one drain in the wettest part, taking care that the fall does not exceed one inch to the yard, and then to carry branches into that drain, at a distance of about ten or twelve yards apart from each other. If the soil is not extremely tenacious, this is near enough to lay it sufficiently dry; and where, as not unfrequently occurs, it is intermixed with gravel, the drains may be at a still greater distance. At

Ridgemont, as is generally the case on strong soils, the spring is chiefly near the surface of the land, and consequently those drains are found most effectual that are laid just low enough to be secured from injury. It has also been observed here, that covered drains always discharge more water, and extend their influence farther on each side than open ones. This probably arises, in part, from the soil of the banks or sides of the open drains becoming hardened by exposure to the air and the changes of the weather, and thus not permitting the water to ooze so freely into them; and partly, perhaps, from the bottom of the channel being frequently in some degree choked up with weeds, or obstructed by clods or crumbs of earth.

About twenty years ago the mole-plough was used here, and, as was thought, with considerable advantage, where the fall was pretty considerable. Some land, which has remained in grass since that period, appears to have been much benefited by it, as the drains continue even yet, though but partially, to discharge water. The orifice which is formed by this implement is however so small that it is exceedingly liable to be choked up; and even in the first instance the pressure occasioned by the implement to the subsoil on the sides of the drains is extremely unfavourable to their operation. On the whole, tile draining is considered to be by far the most efficacious mode, and its expense is the most certainly and abundantly repaid.

FARM-YARD MANURE.

This being the farmer's sheet-anchor cannot be omitted as a separate article, although allusions have been already made to its management and application here, and its proper treatment has been more fully described in the Reports of Scoreby and Wauldby. The scarcity of green crops as winter food is a serious drawback upon the value of the contents of the fold-yard; indeed, it would be impossible to convert the large quantity of straw grown at Ridgemont into perfect manure, without the aid of succulent food, if some plans were not adopted to hasten and promote its decomposition. To effect this, a full stock of swine is kept in the fold-yards, which continually work it over to gather up any scattered or unthreshed grain. But, in addition to this, there is an excellent arrangement in having drains laid at the bottom of the yards to convey the liquid manure to a capacious covered well; from whence, whenever the surface of the yards is too dry, it is pumped up and carted back to the folds. Though the value of urine is well known, it is nevertheless too frequently allowed to be wasted, from the want of a convenient receptacle for collecting it, and some ready means of applying it upon the land. Some cultivators in Holderness have indeed reservoirs constructed for the purpose, but they are rarely met with, and when they are, it is usually the practice to cast out the liquid directly upon grass-lands; though in some instances it is used to form into composts with earth, &c. But the great advantage that is derived here from applying it again and again to the fold-yards, and the very excellent state into which it makes and preserves the manure, is a sort of proof that wherever straw is abundant, and especially if turnips or other succulent food is scarce, there is no other mode in which it can be so economically and so profitably applied as this.

SALTPETRE.

The application of nitre as a manure has not yet been brought into common practice. Sir Humphrey Davy mentions it as a substance that might

be serviceable; but he further observes, that the nitrous salts are too valuable for other purposes to be used as manures. There are, however, several instances where its use has been evidently attended with great advantages.

Nearly twenty years ago it was applied by Mr. Tuke, the intelligent author of the 'Agricultural Survey of the North Riding of Yorkshire,' upon a farm, the property of Lord Headley, at Bramham in the West Riding. It was drilled with turnip-seed upon a limestone soil; the quantity is not known, but it must have been small, as the expense was considerably less than twenty shillings per acre. Yet that the effect was good is fully proved, because the turnips were equal in luxuriance to other parts of the same field where they were sown at the same time upon the usual allowance of farm-yard manure. Some rows were also sown without the application of either nitre or manure, and upon these rows the turnips exhibited no vigour, put out a few sickly, narrow leaves, and failed entirely. It was tried also a few years back by Mr. Bell, of Portington, near Howden, at the rate of eight stones per acre upon various crops, and the result was favourable.

The reporter saw at Ridgemont, on the 6th June, 1832, a field of wheat —another of oats—another of beans—and another of grass meadow, in each of which a plot containing thirty-six square yards had been staked out on the 6th of May preceding, when one pound weight of pulverized nitre was sown over each plot. Attention had been paid in selecting these plots, to place them where the land was of equal quality with other parts of the fields, and not on any outside lands. The effect, at that period, appeared to be the greatest upon the wheat; the grassy-green and broad blade of it exactly resembled what is usually witnessed on a place which had been previously used as the site of a dunghill. On the oat-plot it was nearly, but not quite so strongly marked; but the increased luxuriance might be seen at the distance of 100 yards. On the beans it was visible to an extent that admitted no doubt of its utility. But upon the uncut meadow it was necessary to search for the stakes, which were below the grass. It had certainly done no harm, but it would require a bias in favour of the experiment to say that it would repay the expense. It was then intended to prove by accurate weight of the crops what the effect was upon each, but this by accident was prevented; though Mr. Stickney observed that through the summer the various plots in the corn-fields bore, in appearance, the same ratio, to the other parts of the respective fields, which they exhibited on the 6th of June.

The quantity of nitre here employed was about the rate of 134lb., or 9½ stone per acre. Now as the wheat and oat-crops were decidedly enriched beyond what is desirable, it would appear that one hundred weight per acre would afford a good and sufficient dressing. The price of this may be stated at thirty-two shillings; and if for this expense a surplus produce of eight bushels of wheat, or two quarters of oats, can be obtained, it is evident that nitre may be employed with great advantage to the farmer as a fertilizer of the soil. The value of it would be much increased in places remote from towns or navigable rivers; and where the carriage of manures is particularly expensive, for it will not be unnoticed that one waggon load of two tons' weight would suffice for no less than forty acres of land.

Further trials are, however, yet wanting to prove the general utility of this substance: they may be made at small cost, and with little trouble; and it is hoped that enough has been said to induce some readers of this

statement to turn their attention to the subject, and accurately to ascertain the value of nitre as a manure, and the best mode of its application. It has been asserted, that those soils in the East Indies which particularly abound with this article are peculiarly fertile, and will produce repeated heavy crops in succession as long as the land can be kept free from weeds: in short, that to manure land of this quality is never thought of, and would be entirely useless, on account of its inexhaustible fertility.

September 25, 1833.

OUTLINES OF FLEMISH HUSBANDRY.

HUSBANDRY OF EAST AND WEST FLANDERS.

INTRODUCTION.

The provinces of East and West Flanders and Antwerp, which form a part of the lately established kingdom of Belgium, were early known as the centre of European manufacture and commerce. When the greatest part of Europe was peopled by nations who had scarcely emerged from a state of barbarism, the mechanical arts already flourished in Flanders. Bruges and Ghent were important commercial towns in the 11th century, and supplied the various courts of the south with the rich silks and tapestries, which were then their chief luxuries. They owed this pre-eminence entirely to a persevering industry, which neither a barren soil nor an ungenial climate could repress; and also to a spirit and love of freedom which existed in few other nations of Europe. Whether the careful cultivation and improvement of the soil is to be considered as the cause or the effect of their commercial prosperity, or, as is most probable, agriculture and commerce grew together, and mutually supported each other; the fact is no less certain, that the poor sandy soils of Flanders soon rivalled the rich plains of Lombardy in those productions which are suited to a northern climate. The husbandry of Flanders is consequently an object of peculiar interest; and in order to account for its progress it is necessary to keep in view the close connexion which exists in that country between the farmer, the manufacturer, and the merchant, and the effects of a continually increasing population, in stimulating the exertions of those who provide the necessaries of life. Where there is a great extent of land, and the object of the proprietor is to derive some revenue from it, but there is not a sufficient population to create an urgent demand for agricultural produce, the land is always cultivated in a slovenly manner. The simplest means of invigorating the soil, in this case, when exhausted by crops, is to leave it fallow, that the air and rains may restore some portion of fertility, or to let it lie in grass, that is, to allow the plants which naturally spring up in the soil to spread over it, until their roots shall have furnished a fresh supply of vegetable matter to feed a new succession of crops. Both these methods may be useful, where no better is at hand; but wherever manure can be obtained at a reasonable cost, this is ever found the most effectual restorer of fertility. In a country with a dense population, where the villages are thickly scattered, or where, by means of water-carriage on rivers and canals, manure may be transported to the land at a trifling expense, fallowing and laying down to pasture must necessarily be superseded by increased tillage and manuring. This is the

case in Flanders. If the whole country were laid out in large farms, and a third or fourth part were fallowed every year, or if one half of it were left in natural grass, the population could not be fed; instead of exporting agricultural produce, as is the case now, the Flemings would require a very great importation to supply the demand for internal consumption. Besides, poor soils, such as are found in the greatest part of Flanders, would never be recruited in this way; without repeated manuring no vigorous vegetation would take place; and the land, instead of improving by being left to nature, as some very rich soils may, would return to heath, its original state.

The agriculture of the Flemings has arisen from necessity, and has been encouraged by an increasing population. Commerce and manufactures have multiplied the objects of cultivation by a demand for them. Hence flax, hemp, oily seeds, and various other plants, often produce a greater profit to the farmer than corn; and thus, by diminishing the quantity of land devoted to the growth of food, enhance the value of the latter. Manure, being greedily sought after, soon became an object of commerce, and in a short time a perfect balance was established between the prices of flax, hemp, oil, &c., and corn, hay, and manure, the last always rising as the produce gave a greater profit, after all expenses were deducted.

These preliminary observations are necessary to enable us to find out the true secret of Flemish husbandry, and also to guide us when we attempt to imitate it. For there is nothing more certain in agriculture, than that any produce suited to the climate may be raised on any land, whatever be its natural quality, provided there be no limit to the expense. The coldest wet soils may be made to produce the plants which usually grow in light sands, by effectual draining, deep ploughing, and the addition of silicious and calcareous earths. The most blowing sands may be fixed and consolidated by clay and pressure, and enriched by dung to such a degree as to produce heavy crops of beans and wheat; but such improvements are made merely as experiments, unless they are dictated by absolute necessity. In most cases the cost would not be repaid by the value of the produce; and consequently, no one who cultivates for profit will have recourse to such expensive means.

When Flanders first began to be peopled, the rich alluvial soils along the rivers were probably the only lands cultivated, and the chief object must have been to protect them against inundations. As the population increased, and towns and villages arose, the lands in their immediate vicinity were soon brought into a state of garden cultivation. The manufacturers found it a relaxation to pass from the loom to the plough; and the bread which was the produce of a little suburban farm was preferred to that which might probably be bought at less cost from the regular farmer. We see instances of this every day in the neighbourhood of our great manufacturing towns. But in the course of time this high and artificial cultivation spread all over the country, and prices naturally adjusting themselves to the cost of production, the whole became an enlarged garden, as it may now be considered. Much, however, of this garden culture may with advantage be applied to a greater extent of ground; and if correct accounts are kept, and the increased return for increased labour and manure be taken into consideration, not for one year only, but for a series of years, we have no doubt but it will be found, that the Flemish system of cultivation is economical as well as productive, provided it be followed up systematically, and with a proper knowledge of the principles on which it is founded.

The Flemings do not boast of any great discoveries in the art of tilling

the land. They refer to time immemorial for their usages. There is no record or tradition of the introduction of any particular produce, excepting that of the potato, which they probably obtained first from England. But field-turnips, clover and rape, which we have received from them, have been cultivated there for many centuries. The triennial system which prevailed, and still prevails, over a great part of Europe, has left no traces in the light soils of Flanders; although it is still adopted to a certain extent in the larger farms on the stiff alluvial soils reclaimed from the sea, which they call *Polders*, and also in other provinces of Belgium.

The progress of agriculture has been slow and gradual; and while other nations, and England especially, were continually introducing improvements in cultivation, and new systems of husbandry were proposed and discussed in numerous publications, the Flemings were going on in their old beaten track, like men who have already attained a great degree of perfection in the art they profess. Not a practice has been altered, nor any new produce generally introduced since the potato became a principal object of cultivation, except the white beet-root from which sugar is extracted. Speaking with great impartiality, we may safely assert, that notwithstanding this, the cultivation of a poor light soil, on a moderate scale, is generally superior in Flanders to that of the most improved farms of the same kind in Britain. We surpass the Flemish farmer greatly in capital, in varied implements of tillage, in the choice and breeding of cattle and sheep; and the British farmer is, in general, a man of superior education to the Flemish peasant; but in the minute attention to the qualities of the soil, in the management and application of manures of different kinds, in the judicious succession of crops, and, especially, in the economy of land, so that every part of it shall be in a constant state of production, we have still something to learn from the Flemings; and a detailed account of the mode of cultivation, especially of light lands, in Flanders, cannot fail to be both interesting and instructive.

The object of the following pages is not to make an invidious comparison between the agriculture of the two countries, or between the skill and industry of the two nations, but to draw the attention of agriculturists in general to the principles on which the Flemish practice is founded; so that they may apply them, with proper modifications, to the cultivation of larger farms and other soils, wherever it may be done with advantage; and if the observations we shall venture to make should give hints for the further improvement of practical Agriculture in either country, we shall not think that we have laboured in vain.

It may here be proper to give the reader some account of the sources from which our information is derived. There are few books on Husbandry published in Flanders; if there were, the Flemish farmers would not read them. The only account of Flemish husbandry published in England, as far as we know, besides the short sketch given by Sir John Sinclair, is the report made to the Farming Society of Ireland by the Rev. Thomas Radcliffe, and published in London in 1819. This work contains much useful information, which several tours through Flanders, made for the purpose of inquiring into its agriculture, have enabled us to verify. But his divisions of the country are inconvenient, and may lead to great mistakes in judging of the soil. His account of the cultivation of each district does not always apply to the majority of soils within it. This is however a defect more in a geographical than an agricultural point of view, and we have to acknowledge our obligations to the author in the pursuit of our inquiries. In 1815 Mr. De Liehtervelde of Ghent published a small work called *Mémoires sur les Fonds Ruraux du Département de l'Escaut*,

which consisted of answers to certain queries made to him by order of the French government in 1812, in which many particulars are found which had never before been published.

But the work to which we are most indebted, and which we consider almost in every point, as of complete authority, is the 'Agriculture de la Flandre,' written in Flemish by Mr. Van Aelbroek of Ghent, translated into French and published at Paris 1830. This is the only work of any consequence on Flemish husbandry written by a native of Flanders. Mr. Van Aelbroek was, and is still, a considerable proprietor of land, and a man of great experience and information, who during the course of a long life has made agriculture his study and delight. His work recommends itself in a peculiar manner to our notice; for it was suggested by a prize offered in 1818 by the Board of Agriculture in England for "*the best account of Flemish Agriculture*," and may therefore be said to have been written purposely for the British reader. The original memoir was written in French, and transmitted to Sir John Sinclair. From some circumstances, which have never been explained, and the consequent dissolution of the Board of Agriculture, no notice was ever taken of it, nor could the manuscript be recovered; no answer having been returned to repeated applications for it. The author then recomposed it, in an enlarged form, in Flemish, for the use of his countrymen; and it was soon after translated into French under his own eye. It is much esteemed by the French *Agronomes*, or scientific agriculturists, and has been widely circulated in France. The form of a dialogue which he adopted is less interesting to those who rather seek facts than discussions; and this may be the reason why an English translation might not be suited to the taste of the generality of readers of works on Agriculture; but we must here, once for all, acknowledge our obligations to this work for most of the details we have given, which were found to be correct wherever we had an opportunity of verifying them by our own observations and inquiries.

A geographical dictionary has lately been published at Brussels of all the provinces of Belgium. The Agricultural part is chiefly taken from Mr. Van Aelbroek's work; but there is a short statistical account of every parish, which has been of great use to us. *

Chapter I.

OF THE DIVISION OF THE LAND INTO POLDERS AND UPLAND—FORMATION OF THE POLDERS AND ANALYSIS OF THE SOIL—CULTIVATION—CROPS—SIZE OF FARMS—BUILDINGS, &c.

There are two very distinct classes of land in Flanders, of which the formation is evidently different. The first consists of the alluvial low deposits along the rivers and æstuaries, which have been reclaimed from the sea by embankments, and to which the name of *Polder* is given. The second comprehends all the lands in the interior, varying in texture and fertility, and situated in an extended plain, slightly undulated and gradually

* Since writing the above, we have made another complete tour of East and West Flanders, and had ample means of verifying or correcting every statement which we had made. This has also enabled us to add some account of particular farms, with details communicated to us on the spot.—August, 1837.

rising above the level of the waters. The polders are formed by the deposits of various earths, mud, and vegetable matter, which are brought down by the rivers, and are suspended in the water so long as it remains in motion, but which are rapidly deposited wherever a stagnation takes place. When a rising tide meets the current of a river flowing into the sea, it checks its course, and ultimately produces a complete stillness, until it again begins to ebb. Here banks of mud are gradually deposited; and the water, flowing off gently, forms narrow channels for itself between these banks, which continually increase, until the sea no longer flows over them, except at high tides. Aquatic plants gradually grow on their surface and consolidate it; and they very soon become marshy pastures. In this state they are called *Schorres*, which is analogous to our *Saltings* on the coasts of Kent and Essex. But the fertility of this alluvial soil soon tempts speculators to protect the land by embankments from the periodical inundations to which it is exposed; and the speculation is generally very profitable, although the first outlay is considerable. The first thing is to raise dykes which can resist the waters increased by the force of the winds at the highest tides. Where the direct influence of the sea is diminished by the protection of external sand-banks and shoals, a common mud wall or dyke with a deep ditch on the inner side, carried up some feet above the highest rise of the tide, is sufficient to prevent inundation. The low grounds within the dykes are, however, subject to be flooded by the soaking of the water through the soil, and by the rains. To obviate this inconvenience, the whole is intersected by canals and ditches, which collect the surface water, and discharge it through sluices, which are opened when the tide has sunk below their level: should this not be sufficient, windmills are erected, which raise the water artificially to the height necessary to enable it to flow off. These mills are similar to those used in the fens in England. A double spiral in the form of a cork-screw made of boards placed round a strong wooden axle, works in an inclined trough, which is the half of a hollow cylinder cut down the axis. The lower part of the spiral is immersed in a reservoir into which the water flows, and as it is turned round by the mill, it pushes up the water along the inclined trough, and discharges it at the higher level. No machine can be simpler, or do its work more effectually. There is little or no friction; and, with a certain velocity, very little water is lost. Where the polders are very low, and there is some danger of occasional inundation, they are kept in pasture: but they are so much more valuable when cultivated, that every exertion is made to keep out the water. When they are ploughed up, they are found to consist of a very fine soft clay, intimately blended with a portion of calcareous earth and vegetable matter in a state of decomposition, or more properly, of the substance which is the result of this decomposition, and which has been called *humus*.—(See 'Penny Cyclopædia,' article *Arable Land*, vol. ii. page 221.) It also contains a portion of silicious sand, without which it would not be so well adapted to the growth of corn, and some finely-powdered shells, which also add to the fertility.

In the Dictionnaire Géographique there is the following description and analysis of the soil of the polder of Orderen, in the province of Antwerp, which, although imperfect, because it only takes into the account the mineral substances, and overlooks the vegetable, will however give some idea of the nature of the soil:—

"The soil is soft to the touch, ductile and tenacious. The microscope discovers no shining particles in it. It does not affect the colour of tincture of turnsol, and is consequently neither acid nor alkaline. When it is kneaded into a mass with water it is plastic, like potters' clay: when

baked it forms a brick with a smooth surface: in a strong fire it vitrifies: 48 ounces of the dried soil gave the following result on analysis :—

	Ounces.	Drms.	Grs.		per cent.
"Calcareous sand	6	1	4	or nearly	13
Silicious sand	2	3	10	"	5
Pure clay	39	2	6	"	81
White alumina (*)	..	..	16		
Mica	..	..	6	"	1
Loss	..	1	18		
	48	.	..		100"

An analysis of St. Catharine's Polder is given by Mr. Radcliffe, as follows :—

Alumina	$52\frac{1}{2}$
Silica	21
Carbonate of lime	19
Oxide of iron	$7\frac{1}{2}$
	100

This is not so heavy as the last, and apparently better for wheat, from the proportion of silicious and calcareous earths in its composition. But here also the humus, or vegetable matter, is overlooked, which, however, is the principal measure of fertility in any well constituted soil.

Thaer, in his classification of soils (see Grundsätze der Rationellen Landwirthschaft, Berlin, 1809, vol. ii. page 142), places at the head of his rich alluvial soils one which was found near the mouth of the Elbe. It contains

Fine clay	74
Sand	10
Calcareous earth	4.5
Humus	11.5
	100

If we compare this soil with that of the polder of Orderen, and allow for the omission of the humus, by supposing that it was confounded with the fine clay and calcareous earth, which is very probable †, we shall find a considerable resemblance; sufficient, at least, to give us an idea of great natural fertility in both. When a polder is first embanked, and sufficiently drained to admit of the plough and be sown, it produces a succession of heavy crops, without any manure whatever. Little attention is consequently paid to artificial means of increasing its fertility. All the straw is sold off the farm, and even the dung of the cattle used for the cultivation of the land or necessary to the comfort of the farmer, is sometimes sold to

* This was obtained by evaporating the water which had passed through the filtering paper.

† In the usual mode of analysing soils, by means of acids and re-agents, the mineral substances are separated and their proportions ascertained; but neither the state of division in which the earths exist in the soil, nor the proportion of animal and vegetable matter diffused through it are discovered. It is a chemical analysis, but not an agricultural one. To obtain this last no other agent but pure water should be employed, to separate the earths mechanically by mere washing, diffusion, and deposition. After this the nature of the earths may be chemically examined, chiefly to separate the calcareous from the aluminous earth. The humus is easily separated, being much lighter than the earths and the last deposited from suspension in water. It is distinguished from fine alumina, and from carbonate of lime, by heating it red hot in a crucible: the humus is totally destroyed by fire, but not the earths. A long graduated glass tube is a most useful instrument for ascertaining the nature of soils. A certain quantity is put into the tube, and water is poured on: the whole is well shaken together, and then left to subside. The earths will be arranged according to their size and gravity, the coarser at bottom, and the finer remaining for a longer time suspended in the water. The proportion is thus easily ascertained without a chemical analysis.

manure poorer lands. The whole of the labour consists in ploughing, sowing, and weeding, till the crop is fit to be reaped. The most exhausting crops succeed each other; and in a very few years the land is reduced to the average fertility of the surrounding districts. It is not in the new polders, therefore, that we are to look for models of husbandry: nor is it our intention to dwell long on the system pursued there, which admits of much improvement.

The usual course consists of five or six crops and a clean fallow. The manure, if required, is usually put on the land in the fallow year only. It consists of every kind of dung mixed in heaps, as it is collected from the stables, and turned over, as we do on similar lands in Kent and Essex. Twenty tons of rotten dung per acre are put on before the seed furrow. The fallows are stirred four or five times in the season: but the first ploughing is seldom given before the spring, from a notion that the land, if ploughed before winter, would imbibe so much wet, as to prevent its being ploughed again in spring, and would not then bear the tread of the horses; whereas the solid surface of the stubble allows the water to run off, and the land is sooner fit to be ploughed in spring. There may be some plausibility in this reasoning, but all the benefit of the frost on a compact soil is thus lost; and if they would lay up their stitches in a high and rounded form before winter, and be careful to make artificial outlets for the superfluous water, by numerous water-furrows, there is no doubt but the land might be kept sufficiently dry; while it would derive great benefit from the mellowing effects of the frost and air in winter.

The first crop after a fallow is usually winter barley, of which this land produces great crops when not yet exhausted by over-cropping, or colza (rape or cole), from the seeds of which oil is expressed. The next crop is beans, or oats, the third, flax with clover seed sown amongst it. The fourth year the clover is cut twice, or the second growth is left for seed. The fifth crop is wheat, after which come potatoes, if the land will bear another crop, if not, it is fallowed, and the rotation begins again. It is evident that land which can bear such a succession of crops must be deep and fertile by nature. If it were better managed at first, and its original fertility kept up by a judicious selection of crops, and occasional recruiting with manure, there is no doubt but it would give a still more profitable return in the end. More frequent green crops would improve the system; and by means of these and careful hoeing, fallows might be altogether dispensed with. At present the number of cattle kept in the polders is too small to make sufficient manure. Good and strong horses are kept to plough the stiff soil, which often requires four horses to a plough; but the number of cows and sheep is too small; and the manner in which they are fed in winter, chiefly on straw only, does not denote a knowledge of the great value of cattle in husbandry. Whether the soil be not too heavy for common turnips, we will not pretend to determine, but the Swedish turnip or ruta baga, mangel-wûrzel, white beet-root, and cabbages would thrive well in it. With these a considerable stock of cattle might be kept in good condition in winter, if not absolutely fattened.

The farms in the polders are much larger than in the uplands; 200 acres is not an uncommon tenure; and although this may seem but a small farm to many an English and Scotch farmer, it is a very large one in Flanders, where from 20 to 50 acres are thought as much as one man can well manage. The produce of 200 acres of polders is very considerable in good years, even with an imperfect mode of cultivation.

Labour is comparatively dear in the polders. The air is unhealthy and the population thin. Strangers and all who are not habituated to the

climate, and who are accustomed to breathe a purer air in the interior, invariably suffer from agues: hence those who are seasoned are in request and paid accordingly.

The quantity of seed sown in the island of Catsand, which is of the richest kind of polders, and the average returns, are given by Mr. Radcliffe as follows, reduced to English measures:—

Crops.	Seed per Acre.	Produce.
Winter Barley	69 lb. or $1\frac{1}{2}$ bushel	45 bushels
Rape or Colzat	5 to 7 lb.	40 "
Wheat	2 bushels	30 "
Rye	2 do.	38 "
Beans	$2\frac{1}{2}$ do.	39 "
Oats	3 do.	58 "

Wheat is here the least productive crop; and winter barley is often far more productive than is here stated, especially on new polders, where 70 to 80 bushels per acre are sometimes reaped: and barley is often sown twice in succession, the second crop being sometimes equal to the first. The quantity of seed sown is less than in England, but more than in some other parts of Flanders, where the soil is much inferior. Great pains are taken to choose good seed; and when it is sown, it is carefully covered with earth dug out by the spade from the intervals between the stitches: and, in light soils, well rolled, or trod in with the feet. Thus all depredation from birds is prevented, and every seed springs up; a good preparation of the soil ensures the vegetation; and the plants tiller out abundantly in a rich and mellow surface. The rents are moderate compared with the produce: there is less competition for farms in an unhealthy district, and seasoned tenants are not readily parted with. The farm buildings in the polders are substantial and convenient. There is a great appearance of comfort in the farmers' houses. The greatest cleanliness prevails every where. The polder farmer leads a retired life with his family, having little communication with the towns, or more populous parts of the country. For a great part of the year, especially after rain, the roads are deep and almost impassable. The canals, where any of them lead to towns, are the chief means of communication.

There is a practice in the polders which somewhat resembles the Irish Con-acre. Labourers hire portions of land, ploughed and manured by the farmer, who lets it to plant potatoes in, or to sow flax. A very high rent is paid for these. The labourer plants his potatoes or sows his flax; his family weed and hoe the crop, and gather it in at harvest; and both farmer and labourer gain by the bargain. The potatoes help to keep the family and a cow and pigs during the winter. The flax is prepared and spun at home, and the whole produce is brought to good account.

There is a mode of letting land mentioned by Mr. Van Aelbroek, which is a remnant of the old métairie system. On a farm of 200 or 300 acres, one-third is let with the buildings at a fixed rate; the tenant engages to cultivate the remainder on a joint account with the proprietor; that is, he does all the labour, and the crop is sold on the ground, the price being equally divided between them. This arrangement can only take place where the land requires no manure and little labour. No more effectual way could well be devised of completely exhausting the soil.

We will now take leave of the polders and proceed to the description of the more varied and interesting cultivation of the different soils in the interior.

Chapter II.

OF THE VARIETY OF SOILS IN THE INTERIOR—PROBABLE FORMATION OF THEM—ANALYSIS OF THE POORER SANDS—RECLAIMING OF HEATHS—TRENCHING—LEVELLING—MODE OF CULTIVATION AND GRADUAL IMPROVEMENT.

There are few countries in which the soil varies so much as in Flanders, retaining at the same time a similarity of composition. The chief distinction is between the light sands and heavy loams. On digging to some depth in any part of the country, alternate layers of sand and loam, or clay, and sometimes peat, are found, disposed horizontally, but very irregularly, and with rapid and sudden interchanges. According as the uppermost stratum is a silicious or argillaceous loam, so the soil takes its quality of light or heavy: and these are so intermixed, that every variety and gradation of soil may often be found in a field of a few acres.

It appears probable that the rivers which discharge their waters into the sea through the coasts of Belgium and Holland have often changed their beds, as is always the case on a flat coast. The rivers and the tide, meeting, form sand-banks, called bars, which frequently obstruct the current. New channels are then formed around them. The sand-bank is gradually covered with a deposition of mud, as in the formation of the polders: and this, at some future period, may have the sea-sand again accumulated over it, when the whole level of the river has risen, and all the old channels are filled up. Thus the land is raised, and the shores advance towards the sea. A simple inspection of all large rivers, where they discharge their waters into the sea, clearly shows this to be the natural progress by which the flats and deltas at their mouths are formed; and this will naturally account for the alternations of barren sand and rich loam, and every possible mixture of the two.

The fertility of the polders and of some deep rich loams in the province of Hainhault and in a few spots in Flanders, has given rise to the notion, that the fine crops generally observed through the whole of Belgium, are owing chiefly to a very superior quality in the soil. Travellers hastily passing through the country and observing the abundant harvests, naturally adopt this opinion. But nothing is farther from the real fact. The rich parts of Flanders are but few in comparison to the poor, as an attentive examination and analysis of the soil will clearly show. The average fertility of the land in the provinces of East and West Flanders and Antwerp will be found much below that of our inland counties, leaving Essex and Kent out of the question. If a fair comparison were made, it should be with the poor light soils of Norfolk or Lincolnshire, where industry and the application of capital have overcome the natural poverty of the land, and made it highly productive.

There are, no doubt, some very good lands in Flanders, besides the polders, but the greater part have been reclaimed from a state of barren heath and waste, and would soon return to their original state if neglected for a few years. But the industry and perseverance of the inhabitants are only the more conspicuous and praiseworthy, and make the inquiry into their mode of reclaiming barren heaths and fertilizing them the more interesting and instructive.

The poorest soil is to be found in the province of Antwerp, the only province of the three where there are still to be found heaths of any extent. These are situated on the confines of the kingdom of Holland. The soil is a coarse silicious sand, containing a few particles of a black

inflammable matter like peat, which gives the sand a greyish colour, from which it derives the name of grey sand; such a sand, taken from the heath at Braschaet and analysed, contained, according to the 'Dictionnaire Géographique,' in 48 ounces of the dried soil,—

	Oz.	Drs.	Grs.
Coarse silicious sand	42	2	16
Fine sand mixed with peat	3	5	36
Combustible peat	2	5	19
Small fibres of roots	..	2	10
Loss	..	..	29
	48	..	..

This sand is evidently quite barren in its nature, and it is only by incorporating it with clay or loam, which is frequently found in the subsoil, that it can be made to retain sufficient moisture to keep up vegetation. Water runs through it as through a filtering stone, and sinks till it meets an impervious subsoil, where it necessarily stagnates. But when mixed with a loamy subsoil by deep trenching, it becomes capable of retaining moisture; and by means of manure a scanty vegetation is forced. The roots of hardy plants being once established, the soil gradually improves, and in a few years, by incessant labour and perseverance, it becomes somewhat fertilized.

There is another kind of sandy soil which is also found in the heaths, but which is of a better quality. It is called soft, or sweet, yellow sand. It is of a finer texture, and contains some oxide of iron, which gives it the yellow colour. It is said to consist of

	Oz.	Drs.	Grs.
Loose yellow silicious sand	36	4	28
Finer sand mixed with clay	4	3	39
Fine alumina	6	6	48
Loss	..	1	5
	48	..	..

This sand is much superior to the grey, and with moderate manuring will produce rye, flax, clover, potatoes, oats, and with good management, even wheat.

The next in order ascending towards rich soils, is the sand found in the Waes district of East Flanders. Of this Mr. Radcliffe has given an analysis. It was taken from the neighbourhood of St. Nicholas. But, as we observed before (page 6), the analysis is imperfect from the omission of the humus, to which it owes its fertility; the component parts by no means indicating a fertile soil. These are

Silex	84
Alumina	13
Oxide of iron	3
	100

If we look at Thäer's classes of soil, we shall find that such a soil is placed as low as the 17th, which he values at only 15 per cent. or about one-seventh of the first, or rich wheat land. But if we suppose, as is the case, that the silex is very fine, and intimately blended with a good proportion of humus, it will become a rich sand. It is well known that the sand of the Waes district requires less manure, and produces finer crops than any other sandy soil in Belgium.

When the proportion of alumina is less than one-fourth of the silica, the soil may be called light; if it is half of the silica, it becomes a good loam, fit for wheat: such a soil is found at Sweveghem, near Courtray; its analysis gives, according to Radcliffe,

Silex	63.5
Alumina	35.
Carbonate of lime	0.5
Vegetable fibre	0.5
Oxide of iron	0.5
	100

When a soil contains 40 per cent. of alumina, it may be ranked amongst the stiff heavy soils, such as that which is found near Ninove and Alost: when it exceeds this, the Flemish farmer thinks it too stiff, and requiring to be improved and lightened by lime. The soil near Oustzeele, of which the following analysis is given, is of this kind:—

Silex	49
Alumina	48½
Oxide of iron	2½
	100

This land requires chalk or lime to make it productive, and these are not found in East Flanders. It is a peculiarity of the Flemish soils, that they scarcely contain any carbonate of lime. The only soil which contains calcareous matter is that of the polders, where it consists of finely-comminuted shells. It appears that where alumina greatly abounds it requires to be tempered with a large proportion of carbonate of lime and humus, to be fertile. No such soil however is to be found in the interior of Flanders. The skill and industry of the Flemish farmers is consequently directed chiefly to the improvement of light lands and good loams. When they speak of a heavy soil, it is to be understood merely as a good stiff loam, not too heavy even for turnips: as to the cold wet clays, such as we have in parts of England, they know little of them; and the few spots which are of this nature are left in poor pasture, or produce inferior woods and coppice, not being thought worth the expense and trouble of cultivation. There are some places however in West Flanders where, for want of better soil, they are forced to cultivate cold clays, and the method adopted is good, viz., very deep ploughing, liming and manuring abundantly: under-draining is little understood, but might be introduced with great advantage.

The poor sandy heaths, which have been converted into productive farms, evince the indefatigable industry and perseverance of the Flemings. They seem to want nothing but a space to work upon; whatever be the quality or texture of the soil, in time they will make it produce something. The sand in the Campine can be compared to nothing but the sands on the sea-shore, which they probably were originally. It is highly interesting to follow step by step the progress of improvement. Here you see a cottage and rude cow-shed erected on a spot of the most unpromising aspect. The loose white sand blown into irregular mounds is only kept together by the roots of the heath: a small spot only is levelled and surrounded by a ditch; part of this is covered with young broom, part is planted with potatoes, and perhaps a small patch of diminutive clover may show itself: but there is a heap of dung and compost forming. The urine of the cow is collected in a small tank, or perhaps in a cask sunk in the earth; and this is the nucleus from which, in a few years, a little farm will spread around.

In another spot more extensive improvements are going on; a wealthy proprietor or lessee is trenching and levelling the surface, sowing broom-seed, and planting young fir-trees, which are to be cut down in a few years. In another, the process has gone on further, the firs or the broom are already cut down; a vein of loam has been found, and is dug out to be

spread over the sandy surface: the cart with liquid manure is preparing the surface for the reception of seed, or the same, diluted with water, is poured over the young blade just appearing above ground. The soil is created, and, if the cost and labour were reckoned, is paid for at a dear rate: but perseverance insures success, and there are few instances of improvements being abandoned, after they are fairly begun, unless they were undertaken on too large a scale; but then the land is soon divided into smaller portions, and improvements go on from different centres, and with more certainty.

We are here describing the labour of bringing a soil absolutely barren into a state of cultivation; but in most of the districts which have been originally waste and covered with heath, and which are now fertilized, a less ungrateful soil was found. Deep trenching and levelling at once presented a surface which required only to be manured to produce rye, flax, and potatoes. This is what we should call a moderately good sand, in which a small portion of clay and oxide of iron produces a certain degree of compactness, so as at least to retain moisture: under this kind of sand a stratum of loam is usually found at the depth of two or three feet, and, almost invariably between the sand and the loam, an indurated crust of earth cemented by carbonate of iron, which is well known to all improvers of poor sands by the name of the *iron pan:* this pan must be broken up and the loam under it mixed with the sandy surface, before any cultivation can succeed; and in this operation the Flemings are very dexterous. The instrument they use is a light wooden trenching spade, the end of the blade only being shod with iron: the handle of this spade is about two feet long, the blade from twelve to fifteen inches. A light pick-axe is used to break the pan where it appears. A ditch is dug with the trenching spade two or three feet wide, and as deep as the trenching is intended, generally two feet, or at least twenty inches; this ditch is filled with the earth which is taken in long thin slices from the edge of the solid side of the ditch. Every slice is distributed carefully, so as to mix the whole, and keep the best soil at top, and likewise to fill up hollows and level eminences. If there is more than can conveniently be spread level, little heaps are made of the superfluous earth, which are afterwards carried, in an ingenious manner, to fill up more distant hollows, by means of horses and an instrument which is called a *Mollebart*, of which a description will be given hereafter. Wherever there is a pan, it is carefully broken, and the loam, which is always found under it, is mixed with the sand dug out. Draining is seldom required here, except that which is effected by making deep ditches to carry off the superfluous rain-water, which in a country almost as level as a lake is no great difficulty. A canal near at hand is, however, an essential condition of extensive improvement, to bring manure, and carry off the produce of the land, as well as to be an outlet for the water in the ditches. When Count Chaptal traversed a barren part of Flanders, accompanying the Emperor Napoleon, the latter expressed his surprise, at a meeting of the Council of the Department, that so great a tract of land remained uncultivated in so industrious a nation. The answer was, "If your majesty will order a canal to be made through this district, we pledge ourselves that in five years it will be all converted into fertile fields." The canal was ordered to be made without delay, and in less time than they promised not an unproductive spot remained.—(See Chaptal, 'Chimie Appliquée à l'Agriculture,' vol. i. page 347.)—One great cause of the agricultural prosperity of Flanders is the ready transportation of manure and produce by canals.—But to return to the newly trenched land. If there is no manure at hand, the only thing that can be sown on poor sand, at first,

is broom: this grows in the most barren soils; in three years it is fit to cut, and produces some return in fagots for the bakers and brickmakers. The leaves which have fallen have somewhat enriched the soil, and the fibres of the roots have given a certain degree of compactness. It may now be ploughed and sown with buckwheat, or even with rye without manure. By the time this is reaped some manure may have been collected, and a regular course of cropping may begin. As soon as clover and potatoes enable the farmer to keep cows and make manure, the improvement goes on rapidly; in a few years the soil undergoes a complete change: it becomes mellow and retentive of moisture, and enriched by the vegetable matter afforded by the decomposition of the roots of clover and other plants. It is surprising that so few sheep should be kept on these new farms. Sheep fulded would do good by their tread, as well as their manure, but the management and feeding of sheep is a part of husbandry in which the Flemings, with very few exceptions, are decidedly as much behind our light land farmers, as they are before us in the feeding of their cows, and preparation and economy of manure.

If about twenty small cart-loads of dung can be brought on each acre of the newly trenched ground, the progress is much more rapid. Potatoes are then the first crop, and generally give a good return. The same quantity of dung is required for the next crop, which is rye, in which clover is sown in the succeeding spring; and a small portion is sown with carrots, of which they have a white sort, which is very productive and large in goud ground, and which, even in this poor soil, gives a tolerable supply of food to the cows in winter. Should the clover fail, which sometimes happens, the ground is ploughed in spring and sown with oats and clover again. But if the clover comes up well amongst the rye stubble, it is cut twice, after having been dressed with Dutch ashes early in spring. It is mostly consumed in the green state. The clover-ley is manured with ten cart-loads of dung to the acre, and rye sown again, but not clover. After the rye comes buckwheat without any manure; then potatoes again, manured as at first, and the same rotation of crops follows. It is found that the poor land gradually improves at each rotation from the quantity of dung used: and, as this is essential, it will be easily seen that without water-carriage the improvement could not go on: for the necessary quantity of dung could never be brought to the ground by land-carriage through the deep sandy roads, which are mere tracks.

For want of sufficient manure, broom-seed is sometimes sown with the rye after the clover. The rye is reaped and the broom continues in the ground two years longer. It is then cut for fuel. The green tops are sometimes used for litter for the cows, and thus converted into manure. It is also occasionally ploughed in, when young and green, to enrich the land. Oats, clover, and broom are occasionally sown together. The oats are reaped the first year; the clover and young broom-tops the next, and the broom cut in the third. This is a curious practice, and its advantage appears rather problematical. All these various methods of bringing poor sands into cultivation show that no device is omitted, which ingenuity can suggest, to supply the want of manure.

After the land has been gradually brought into a good state, and is cultivated io a regular manner, there appears much less difference between the soils which have been originally good, and those which have been made so by labour and industry. At least the crops in both appear more nearly alike at harvest, than is the case in soils of different qualities in other countries. This is a great proof of the excellency of the Flemish system; for it shows that the land is in a constant state of improvement, and that the

deficiency of the soil is compensated by greater attention to tillage and manuring; especially the latter. The maxim of the Flemish farmer is, that "without manure there is no corn—without cattle there is no manure,—and without green crops and roots cattle cannot be kept." Every farmer calculates how much manure he requires for his land every year. If it can be bought at a reasonable rate, he never grudges the outlay. If it cannot be purchased, it must be made on the farm. A portion of land must be devoted to feed stock, which will make sufficient manure for the remainder: for he thinks it better to keep half the farm only in productive crops well manured, than double the amount of acres sown on badly prepared land. Hence also he does not reckon what the value would be of the food given to the cattle, if sold in the market, but how much labour it costs him to raise it, and what will be the increase of his crops from the manure collected. The land is never allowed to be idle, so long as the season will permit anything to grow. If it is not stirred by the plough and harrows to clear it of weeds, some useful crop or other is growing in it. Hence the practice of sowing different seeds amongst growing crops, such as clover and carrots amongst corn or flax; and those which grow rapidly between the reaping of one crop and the sowing of another, such as spurrey or turnips, immediately after the rye is cut, to be taken off before wheat-sowing. These crops seem sometimes scarcely worth the labour of ploughing and sowing; but the ploughing is useful to the next crop, so that the seed and sowing are the only expense; and while a useful crop is growing, weeds are kept down. These are the general principles of Flemish Husbandry. Before we enter into the particulars, we may give a short account of the instruments in use, which are few and simple.

Chapter III.

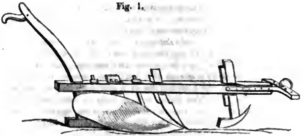
IMPLEMENTS OF HUSBANDRY—MODE OF PLOUGHING.

The spade and shovel are used much more extensively in Flemish cultivation than they are in other countries. Manual labour is not spared. The trenching spade, which we mentioned in the last chapter, is used in the old improved lands as well as in those first reclaimed from the state of waste. All the light lands in the Waes district are trenched twenty inches deep or more, every six years, and all idea of fallows is abandoned. The intervals between the stitches, where the ground is ploughed in this manner, that is in the heavier loams, are all done out with the spade and shovel, as neatly as the intervals between asparagus-beds are in a well-managed garden.

The Flemish hoe with which they hoe and mould up potatoes, is much longer in the blade than those in use in Britain. It resembles a small spade with a handle bent at an angle of 60° to the blade: it is a very efficient instrument, and is used for many purposes where spade work would be too tedious.

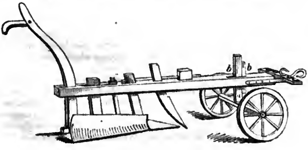
There are two kinds of ploughs in use, differing from each other as much as can well be imagined; these are the old Walloon plough, which is our heavy Kentish turnwrest-plough with wheels, and the light single-handled Belgian swing-plough, called there also a foot plough, as it is in some parts of England (see fig.). This, which is the model of the Rotheram plough, is the parent plough of all our most improved swing-ploughs for light soils.

Fig. 1.



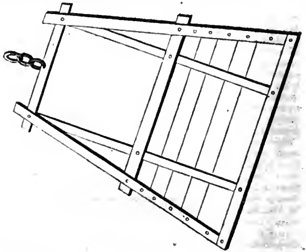
The turnwrest plough is in use in the polders, and in some few heavy-land farms in the interior; but it is almost entirely superseded by the swing-plough, which, when made somewhat stronger, is found to work equally well in strong loams as in light sands. It must however be remembered, that in Flanders a soil is called heavy, which would be called comparatively light in many parts of England, as in Kent and Essex, and which is light enough for turnips. The Belgian swing-plough (fig. 1) acts on the principle of a shovel. The share is very broad; the sole is a kind of sledge, formed by the end of the share towards the heel, and the lower edge of the turn-furrow. This last is made of a sheet of wrought iron about half an inch thick, and bent as if it had been rolled round a cylinder. The fore-part of the share is sharp on the right edge, and spreads to the width of ten or twelve inches where it joins the turn-furrow, which is here verys lightly inclined to the horizon, so as to slide under the furrow slice, and lift it up before it turns it over. The upper edge of the turn-furrow winds in a regular curve from the left side of the point of the share, till it forms an angle of 45° with the horizon on the right hand of the ploughman, laying the slice turned over at that angle against the preceding slice. The hendle or horn is nearly vertical, slightly bent and tapering at the end. It has a horizontal projection on the hinder part, shaped so as to be easily grasped in the hand, by which the whole plough is readily held, and lifted out of the ground, at the end of the furrow, to enter it into the next. The whole is so light and of so easy draught, that in light lands a single horse is sufficient to plough an acre in a day to the depth of six or seven inches. When the day's work is done, the point of the share is let into a hook fixed on a little sledge which carries the plough, the ploughman then mounts the horse, and trots briskly home. He returns to the field in the same way in the morning.

There is a variety of the turnwrest-plough, used near Roulers, much lighter than the great Walloon plough (see fig.). It has two small wheels,



which are connected with the beam of the plough by a small bar of iron ($a\ b$), which rises from the middle of the axle at a and goes through a mortice in the beam at b; it regulates the distance of the beam from the centre of the axle, while this last can take any position, with respect to the horizon, which may be required to keep the connecting bar in a perpendicular position, when one wheel is in the furrow and the other on the unploughed land. This is effected by means of a pin (at a), which passes through the axle and the end of the bar, and forms a joint like that of the beam of a balance. The length of the beam of the plough is six feet. The sole is nearly half of this length, and the wheels are only eighteen inches before the insertion of the coulter. The whole is nearly as light as the swing-plough, and is of great use in breaking up clover-leys.

Besides these ploughs, they use light harrows with wooden tines set at an angle forward in the cross bars of a triangular frame, which is drawn by the angle towards which the tines are inclined, when the object is to bring up weeds; but from another angle, when it is used to cover the seed, or to smooth the surface after the seed has been lightly ploughed in. Rollers of various sizes, some of stone, but generally of wood, are used to roll the crops in spring, and settle the roots in the ground; but the large heavy roller for grass-land is not in use, although it would be very advantageous in compressing loose meadows and levelling their surface for mowing. There is an instrument peculiarly Belgian, called a *traineau*, or



sledge (see fig.). It is a frame of wood covered with planks, which is drawn along the land to break clods and to leave a smooth surface. It is very effectual in doing this, and is useful in loamy soils: its effect is somewhat like a combination of a bush harrow and a roller. Iron teeth put in obliquely in one or more rows are sometimes added to this traineau in stiff soils to break the clods. The man or boy who drives the horse which draws the traineau usually stands upon it, and by his weight keeps it level. The frame of a roller is sometimes made so that it rests and drags on the ground, and acts like a traineau in breaking clods before the roller. A

strong rodded hurdle is also used as a hush harrow, to level the surface in light lands.

Besides the common scythes, hoes and rakes, there is a peculiar instrument for cutting corn, called the Hainault scythe, of which notice has been taken in many agricultural publications. It is a very useful instrument, and in the hands of an experienced person will cut a third more corn, in the same time, than can be done with the reaping hook. It is a short scythe, of which the blade is broad and about twenty inches long. The handle is about the same length, and fixed so as to form an acute angle with the blade, when in the act of cutting: it is bent outward at the end where it is held, at an angle of about 120°, and is there shaped like the stout handle of a knife or turning tool. It should be so constructed, that, when the blade lies flat on the ground, the man's hand is nearly perpendicularly over the centre of the curve of the blade, so that he can swing the instrument, by a motion of the wrist, without stooping. A leathern strap doubled and nailed on the handle, in which he puts the fore finger, prevents its slipping from his grasp. In the left hand he holds a light stick three or four feet long, having an iron hook fixed at the end, bent into a semicircle of about eight inches diameter. With this hook he collects the standing corn, and lays it towards the left, while the right hand cuts it close to the ground. The cut corn leans against that which is standing; and when as much has been cut as will make half a sheaf, the workman turns half round, and hooking up part of what is cut with as much of what is standing, he cuts and rolls up the whole in the form of a sheaf, using his leg and foot to keep it in the bend of the blade: the legs are protected by pieces of strong leather over the shins. Thus it is laid down for the binders. Those who are accustomed to the method of fagging in use in Middlesex, Surrey, and the neighbourhood, where straw is valuable, will readily see that this scythe is only an improved fagging hook, allowing the reaper to stand upright at his work, and saving that fatigue of the back which is the chief inconvenience of fagging. For women, to whom stooping is not so laborious, the fagging hook may perhaps do the work as conveniently. But, in Flanders, women only tie up the sheaves, and seldom reap. This instrument has been often recommended for use in England; and we have ourselves made presents of it to reapers who cut by the acre. Very few had the patience to become dexterous in the use of it, and after a few trials returned to the old fagging hook; although it was evident, that it would, if properly managed, cut one-third more corn, at least, in the same time. It is, however, inferior in expedition to the cradle scythe in the hands of a skilful mower. This last is also used in Flanders, but not so commonly as the foregoing.

The Mollebart, the use of which in the levelling of newly-trenched land, has been before mentioned, is an instrument peculiarly Flemish or Dutch. It is simply a very large wooden shovel, in form like the tin dust-pans used by housemaids, with a stout long handle. (See next page.) The bottom, which is convex, is covered all over with thin iron plates; and a stronger piece of iron (*c d*) forms the edge. The handle (*a*) is six or seven feet long, firmly fixed to the shovel, and so placed, that when the end is raised five or six feet high, the only part of the instrument which touches the ground is the edge (*c d*). When it is held three feet from the ground the shovel rests on the convex bottom (as at *e*), with the edge rising a few inches above the ground; and when it is pushed quite down, and it drags on the ground, the instrument rests on the hinder part of the bottom (*b*). The width of this shovel is about three feet, and the length from the insertion of the handle to the sharp edge is nearly the same. Sometimes it is wider

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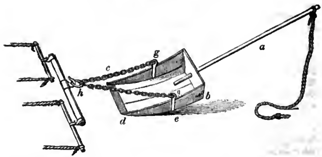
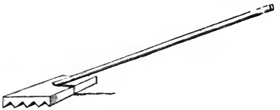


than it is long. In the middle of the border on each side is a strong iron hook (g), which is connected with the iron on the bottom. It is drawn by chains fixed to these hooks, united into a large link (h) a little before the edge of the instrument. To this link are attached a common whipple-tree and bars, to which two horses are yoked abreast. Attached to the end of the handle is a strong rope of the size of a man's little finger, fourteen or fifteen feet long. This the driver holds coiled in the same hand which holds the handle, the reins being in the other. It is now ready to begin its operations. The man depresses the handle, so that the edge of the shovel rises upwards, and directs the horses towards a heap or an eminence to be removed. As soon as they reach it the handle is raised, the edge of the instrument enters the ground, or the bottom of the heap, and it is soon filled with loose earth. The handle is immediately depressed, and the whole load slides on the bottom of the shovel over the sandy surface until it arrives at the hollow which is to be filled. The handle is then raised suddenly as high as the man can reach; the edge catches the ground, and the whole machine is overturned forwards, the handle striking on the whipple-tree; the load is thus left behind. The rope, of which the workman kept the end fast in his hand, now comes into use, and by pulling it the instrument is again reversed, and proceeds empty for a fresh load. All this is done without the horses being stopped for a moment. A skilful person will spread the earth at the same time that he deposits it: this is done by holding the rope so that the handle shall not fall over at once, but remain for a short time in an erect position. The earth is thus delivered gradually, and laid level by the edge of the instrument scraping over it. It is astonishing how much labour and time are saved by using this instrument instead of carts. It takes up about 500 cwt. or more of earth each time, and this load slides along with the greatest ease to the horses: in returning they generally trot. More complex instruments have been invented to answer the same purpose, some of which are extremely ingenious, but the simplicity of this, and the small expense at which it may be made by any common wheelwright or carpenter, or even by the farmer himself, strongly recommend it; and we do not hesitate to assert, that, with a very little practice, any common labourer, who can manage horses, will do as much work with this simple instrument as he would with the more perfect and ingenious machine, which obtained a prize from the Highland Society some years ago.

Instead of the common flail to thresh the corn, another instrument is used in the Waes country and some other districts, which is of a peculiar

form (see fig.): it consists of a solid block of hard wood, about ten inches long, eight wide, and three thick, in the lower part of which there are angular grooves cut, about an inch and a half deep: a stick like the handle



of a flail is inserted obliquely into this block, so that when it is raised and struck on the floor it falls with the grooved surface flat on the corn which is laid down tied up in sheaves. It beats off the chaff as well as the corn, and detaches it from the straw, which the flail does not do so completely. This chaff is mixed with the boiled food for the cows.

Besides the above-mentioned, the Flemish farmers use very few instruments; and they have not adopted any of the new inventions which are used in England. They have no drills, horse-hoes, scarifiers, nor threshing machines; they use the winnowing-machine, but the common fan and riddle are still very generally employed to clean the corn when threshed.

In ploughing the land, in some districts they lay it flat, without divisions. In others, as the Waes district, the fields are all laid in a convex form when they are trenched, and kept so by ploughing round in a circle upwards towards the centre. Where the loam is not very pervious to water, they lay the land in stitches seven or eight feet wide, as is usual with us. They plough across the stitches occasionally, and reverse the crown and furrow, or change the interval so as to be in a different line every year, which in the end tends to deepen the whole soil. The depth of the furrow varies according to seasons and circumstances, and there is much skill and ingenuity displayed in doing this so as to divide the ground well, and lay the dung where it is most effective. When weeds are to be destroyed a very shallow skimming is thought sufficient. In autumn the dung is ploughed in a few inches deep only, to allow the access of air to decompose it. In the following spring the furrow is several inches deeper, to bring fresh earth to the surface without uncovering the dung. When a first ploughing has been very deep to bury weeds, the next is often shallow to divide the slice first turned over, and not bring up the seeds again within the influence of the atmosphere, which would cause them to spring up*. In all this there is a great attention paid to every operation that it be performed most effectually. No more ploughings are given than are thought essential to each particular crop. A great object is to have an early harvest, both because the weather is generally driest and best early in summer, and because a second crop may be sown before the midsummer showers. Winter barley is on this account preferred to spring barley; and rye is sown early, that turnips may be sown with some chance of success, immediately after it is reaped. Summer stirring and liquid manure keep the land in a clean and rich state, and it is not allowed to remain idle. The heavier soils are laid up high before winter; the intervals between the stitches are well dug out with

* It is evident that the furrow slice must, in this case, be turned quite over and laid flat, and not leaning on the preceding, as in ordinary ploughing.

the spade, and numerous water-furrows are dug across them, that no water may stand anywhere after rains. The winters are more severe on the continent than in Britain; and even in Flanders, which is so near to us, the frost is much longer and more intense. But this is taken advantage of to expose stiff soils to its influence.

They have a practice in some parts of Flanders of digging out spits of earth with the spade from the bottom of the furrows, after the plough has passed, and setting them up on the surface already ploughed. This is done by several men before the plough returns and fills the cavities thus made with the earth of the next furrow. These clods are left exposed to the air and frost, and are afterwards levelled down with the harrows. Mr. Van Aelbroek, with whom this is a favourite operation, calls it the atmospherical manuring, which he thinks equal in effect on the soil to half the usual coat of dung. Whether the advantage be as great as he represents it or not, we will not venture to decide; but it tends to make the soil mellow and friable, and then the manure put on will have a greater effect, and a smaller quantity will be required.

Chapter IV.

OF THE DIFFERENT KINDS OF MANURE AND THEIR APPLICATION.

The collection and application of manure is the great secret of Flemish Husbandry. Upon their poor light soils nothing could be raised without an abundance of manure. It is consequently an object of minute attention to the Flemish farmer to collect as much as possible, and to apply it in the most advantageous manner. For this purpose the dung of the different domestic animals is generally kept separate, especially that of cows, from that of horses; the former being thought better for dry sandy soils, the latter for colder loams and clays. They look upon pigs' dung as cold and inferior, adopting in this respect the opinion of the ancients. We think differently; but this may be easily accounted for. The Flemish store-pigs are fed in the most miserable manner, and are merely kept alive on weeds taken from the fields, or by very scanty grazing in rough pastures. We need not be surprised therefore that their dung is poor. The cows are better fed, and their dung is consequently richer. Cow dung is thought to last longer in the soil, and its effects on the second crop are more conspicuous than that of horse dung, which stimulates more and is sooner effete. Sheep, which are so important to the light-land farmer in England and Scotland, for their manure, are not kept in sufficient quantities in Flanders, nor well enough fed to do much good to the land. They are commonly housed every night, and driven about in the day to gain a scanty subsistence along the roads and sides of fields. The manure collected in the sheep-fold is carried out on the land, and its effects are duly appreciated. A flock is occasionally folded on a clover ley before it is ploughed up, but never on the turnips, which are always given to the cows. This is owing to the small extent of the farms, which do not allow of a considerable flock of sheep being kept by any one farmer; but a flock is made up of different lots of sheep belonging to several proprietors, and put under the care of a common shepherd, or it is sometimes

the property of the shepherd, who occupies no land, but lets out the sheep to fold, or sells the manure.

But the great auxiliary of the Flemish farmer is the URINE TANK, wherein are collected not only the urine of cows and horses, but also the drainings of the dung-hills. The urine tanks are generally sunk below the level of the ground, and have the sides built of brick, and the bottom paved: they are of various dimensions, according to the number of cows and horses on the farm. Attached to the distilleries, where many beasts are constantly kept to consume the refuse wash, there are very large urine tanks of an oblong shape, divided by partitions into different chambers, so that the liquor may be of the proper age when it is used, which some farmers think ought to be six months. Each chamber is about eight feet square and six or eight feet deep: these are sometimes vaulted over, but frequently only covered with loose boards. As urine and the emptyings of privies are sold wholesale and retail, there are many large tanks near the rivers and canals, where the dealers have sometimes great quantities in store. Some of these consist of many square pits like tan-pits, bricked round, and the inside covered with a cement, which prevents loss by filtration. There is generally in a corner of each pit a graduated scale, by which the number of barrels, or tons of liquid in the tank may be ascertained by observing the height of the surface. These tanks are gradually filled by boat-loads brought from the large towns; and when the season arrives for sowing, in spring and autumn, the farmers come with their carts and tubs, and purchase as much as they may want. The price varies from three to five francs (two shillings and sixpence to four shillings) per hogshead according to the quality. In a small farm of thirty to forty acres the tank is generally about twenty feet long, twelve wide, and six deep, with a partition in the middle, and arched over, leaving an opening for the pump, and another sufficient to allow a man to go in to empty out the earthy deposit which falls to the bottom. A trap-door shuts over this aperture to prevent accidents. Sometimes the tank is round like a well, with a domed top, and so deep in the ground, that it has a foot or two of earth over it. The situation of the tank is either in the farm-yard near the entrance of the cow-house, or immediately behind it; sometimes it is like a cellar under the building; but this is apt to cause a disagreeable smell in the cow-house. We here describe those which we consider the most convenient: the form and capacity of the tanks vary greatly according to the means and notions of the proprietors of the farms: but a tank of some kind or other is considered as indispensable an appendage to a farm as a barn or cow-house. The farmer would as soon think of dispensing with his plough as with his tank: and no expense or trouble is spared to keep this well supplied. The numerous towns and villages in Flanders afford great help in the way of manure. The thrifty housewife and her active substitute the maid, know the value of what in our households is thrown away or wasted and lost. A small tank, or a tub sunk in the ground in some corner contains all the liquid which can in any way be useful; soap-suds, washings of dishes, &c., are carefully kept in this reservoir, until, once a week, the farmer or contractor calls with his tub on a cart; and this, mixed with the contents of privies, which are frequently emptied, he keeps in large cisterns for use or sale *.

* In Ghent we were informed that the sum paid to the servants for the liquids collected, and which is their perquisite, often amounts to as much as they receive for wages; and as consequently the wages are proportionally lower, it is in fact the masters and mistresses who benefit by it.

But this supply is not always adequate to the wants of the farmer, and then he has recourse to rape cakes dissolved in water, or in the tank, which is expensive, and can only be profitable where flax bears a good price, this being the crop for which rape cakes are chiefly used as manure. Every means, therefore, of augmenting the supply of urine is had recourse to, and the most efficacious is the establishment of distilleries. These answer the double purpose of consuming produce and increasing manure by the number of beasts which are fattened on the refuse wash. It is calculated that every beast produces at the rate of ten or twelve tons of dung and twenty-six hogsheads of urine in the year. A moderate distillery has fifty or sixty head of cattle constantly stalled. Here then is a supply of manure for several hundred acres of land every year. Formerly there were a great many distilleries in Flanders, but the duty on spirits and the interference of the government has much reduced their number; so that the farmers complain of the loss of this manure, and the consequent deficiency of their crops.

The dung of pigeons and domestic fowls, where it can be collected in any quantity, is highly valued. The mode of using it is either in a dry and powdered state, to which it is reduced by thrashing with a flail, when it is sown with the seeds of leguminous plants, or else dissolved in the urine tank, and thus spread over the land. This manure is chiefly reserved for kitchen gardens; it promotes the growth of vegetables and produces no weeds.

The solid dung, from which the liquid has been allowed to run off into the tank, must be carefully attended to, that it may not be too dry and become *foxy*, as it is called, or burn. It is therefore mixed up with earth and any useless vegetable matter which can be collected into a heap or compost; and when it appears too dry some of the liquid from the tank is poured over it, to excite fermentation and accelerate decomposition, or it is merely watered, when there is sufficient strength in it to produce heat.

In order to increase as much as possible the quantity of solid manure, there is in most farms a place for the general reception of every kind of vegetable matter which can be collected: this is a shallow excavation, of a square or oblong form, of which the bottom has a gentle slope towards one end. It is generally lined on three sides with a wall of brick to keep the earth from falling in, and this wall sometimes rises a foot or more above the level of the ground. In this pit are collected parings of grass sods from the sides of roads and ditches, weeds taken out of the fields or canals, and every kind of refuse from the gardens: all this is occasionally moistened with the washings of the stables, or any other rich liquid; a small portion of dung and urine are added, if necessary, and when it has been accumulating for some time, it is taken out; a portion of lime is added, and the whole is well mixed together; thus it forms the beginning of a heap, which rises gradually, and in due time gives a very good supply of rich vegetable mould, or compost well adapted to every purpose to which manure is applied. The place where this accumulation is made is called in French a *croupissoir*, and in Flemish or Dutch *smoor hoop*, which may be translated *smothering heap*.

Besides the manure which is collected on the farm *, the *vidanges*,

* Since the above was written, the subject of liquid manure has been very ably brought to the notice of agriculturists in a small work by Mr. Cuthbert Johnson, and also by a paper of Mr. Kimberly, in which he announces an important discovery, made by himself, in the management and acceleration of the putrefactive fermentation in vegetable substances. The great activity of manure applied in a liquid state, especially in very light

or emptyings of privies obtained from the towns, and the sweepings of streets, a large quantity of peat ashes imported from Holland are used, principally as a dressing for clover. These are the ashes of the common fuel in use in Holland, and are sold in Flanders by the bushel, as the Newbury ashes are in Berkshire. Mr. Radcliffe has given an analysis of these as follows:

Silicious earth	32
Sulphate of lime	12
Sulphate and muriate of soda	6
Carbonate of lime	40
Oxide of iron	3
Loss	7
	100

The effect of these ashes seems to be very similar to that of the Newbury ashes, and by comparing the analysis of the two, we may be led to the ingredients on which the result chiefly depends. Newbury ashes, according to Davy, are composed of

Oxide of iron	48
Gypsum (sulphate of lime)	32
Muriate and sulphate of potash	20
	100

It appears therefore probable, that the effect depends on the combination of the lime, or the alkalis with sulphuric or muriatic acid, and that the silica in the Dutch ashes, and the iron in those from Newbury, have little or no effect on vegetation. This accords with the experiments made with gypsum. The great effect of the ashes in Flanders may arise from the total absence of calcareous earth in the light soils on which they are chiefly used. In the polders they are thought of so little value, that the ashes produced by the burning of weeds are often collected, and carried in boats to be sold for manuring the lighter soils of the uplands. But these are not so valuable as the peat ashes.

Wood ashes, after the greater part of the alkali has been extracted for bleaching, are still considered as of great use to the land. Soapers' ashes are in great request for cold heavy soils; and sugar scum from the refiners, if it could be procured in sufficient quantity, would be an excellent manure for every kind of soil. Where it can be obtained, they usually throw it into the urine tank; and the mixture is then considered as almost equal to the vidanges, which are looked upon as the *ne plus ultra* of manures. Soot is used as a top-dressing for wheat, or clover in spring, as it is with us. It is thought to destroy insects and hasten vegetation.

The weeds, which grow abundantly in all ponds, canals, and ditches in this level country, where the current is never rapid, are mown in spring, and used in their green state as manure for potatoes. They are laid in the furrows, and the sets placed over them; the furrow is then filled up by the plough, and the weeds decomposing very rapidly, greatly assist the growth of the potato plants: so rapidly do these weeds ferment, that much of their value is dissipated, if they are left only forty-eight hours in heaps before they are put into the earth.

We have already noticed rape cake dissolved in water as a substitute for urine; it is also used in powder, either as a top-dressing, or sown with the

soils, is well known to the Flemish farmers; but they know also that it is rapidly exhausted, and requires to be repeated annually, unless solid dung be used at the same time.

seed. The practice of sowing in drills, and putting in dry manures in contact with the seed by means of drilling machines, has never been adopted in Flanders; nor has the use of ground bones been hitherto introduced to any extent. There is perhaps no modern invention which would be so applicable to the Flemish sands, or so advantageous*.

The manner in which manure is applied to the land for different crops will be explained as these are separately treated of: but the general principle, which pervades the whole system of manuring, is worthy of attention. Two great objects are always kept in view. The first is to obtain the most abundant crop of whatever is sown: the next is to impregnate the soil with an increasing power of production, if possible, or at least to maintain that which has been obtained. In consequence of this, almost every crop has a certain portion of manure applied to it, which varies according to the nature of the crop to be raised, and that which has preceded; experience having taught that some crops exhaust the soils more than others.

But it is not the mere surface that they desire to manure. They well know that the deeper the soil is fertilized, the greater will be the profit, and the less the labour. They are not satisfied with enriching the land to receive the seed, they furnish food for the growing plant in different stages of its growth, if they think it necessary. There is in consequence no fluctuation in the growth, no check at a time when the plants require support. The seed is made to vegetate rapidly by being in contact with the rich juices of the manure; and hence a much smaller proportion of seed is required. The young blade is invigorated by a judicious watering, and is sooner out of danger of the attacks of insects.

Liquid manure is carried to the fields in common water-carts, which consist of two wheels and shafts, carrying a cask containing from sixty to one hundred and twenty gallons of liquid. The cask has in the under part a hole, two or three inches in diameter, secured inside by a valve: under this is a board a little slanting, to spread the liquid as it flows out of the cask. A man usually rides on the horse which draws the cart, and holds in his hand a string, which passes through a hole in the cask, and opens the valve when required. There is an advantage in riding on the horse, as it does not add to the weight of the load on the wheels, which in light soils would be apt to sink deep. In a momentary exertion it assists the horse by the weight on his back; and the heavy Flanders horses are well able to carry a man and draw a light load at the same time. When the cask is empty the horse trots home for another load, and no time is lost. It is astonishing what advantage there is in accustoming horses to trot when they have no load; it actually fatigues them less than the continued sleepy walk. Who would suppose that the Flemish and Dutch farmers surpassed us in activity? but whoever has been in the Netherlands in hay-time or harvest must acknowledge it.

The dung which is carried in a solid state, is generally used at a time when it is in active fermentation, as it is then supposed to have the best effect. To ensure this in some districts, as the Waes country, where the minutest attention is paid to every circumstance which can increase fertility, the dung is laid on the field in moderate heaps, and on each heap a certain quantity of urine is poured to excite and renew the fermentation: when it becomes sensibly heated, the dung is spread out and immediately ploughed

* Since writing the above, we understand that the Belgian Government, having ascertained the great advantage of bones for manure, and also in making animal charcoal for the refining of sugar, has laid a heavy duty on the exportation of them.

in. After ploughing in the manure, the land is left for some time, and then a second deep ploughing is given to incorporate the decomposed dung with the soil, but so as not to bring any to the surface. A short time before sowing, the liquid manure is poured over; and this enriches the surface to make the seed germinate sooner.

Lime is not much used in the light soils, but commonly in the cold and stiff. As it is generally brought from a distance, it is dear; and this prevents any extensive application of it. Marl is found in a few spots, and serves to improve the poorer lands within reach of it.

Chapter V.

SUCCESSION AND ROTATION OF CROPS ON DIFFERENT SOILS.

Experience has long convinced the Flemish farmer that there is an advantage in frequently changing the crops on the same land: and in the choice of these he finds that there is a difference in the return, according as certain crops follow one another. In the course of time fixed rules have been laid down, from which a prudent farmer seldom deviates. The approved rotations, in general, accord with sound theory; and where they do not, we must pause before we condemn, and take all circumstances into consideration. We must consider, first of all, what produce is most wanted, or for which there is the greatest demand; as that will always be the most profitable in the market: next the quality of the soil with respect to that produce, compared with others; and lastly, by what means a given soil may produce this in the greatest perfection and at the least expense. As far as the different crops are concerned, it is a mere matter of calculation, which it is most profitable to sow. But this may be greatly modified by the effect of the crops on the subsequent produce, or by the wants of the cattle, which must be kept for the sake of their dung. Hence in one situation, a rotation may be the most advantageous, which in another is not so. Where an unlimited quantity of manure can be procured, it may not be necessary to raise so much food for cattle. Where wheat is in great demand, it may not be worth while to sow rye, if wheat will grow as readily with a little more manuring. Where rye is the chief food of the population, and the soil produces it more readily than wheat, as is the case in all sandy soils, rye is the principal crop. Where barley is in demand, and the soil consists of a thin coat of earth over a solid chalk, as is the case in some parts of England, barley naturally becomes the chief crop; and so likewise in the polders, where extraordinary crops of barley are grown, this grain is the most profitable. Green crops and roots, excepting potatoes, which are become a principal food of man, must be considered as subsidiary crops, raised only to increase manure by means of cattle, or to reinvigorate the land exhausted by corn crops. If Tull's system could have been established, and wheat could have been made to grow on the same land, year after year in succession for ever, no advantage would have been obtained, because it would soon have been as common as oats; but rotations would have been useless. But setting aside theories, it has been clearly proved by experience, that variety of produce is essential to continued fertility. Even where no rotation is apparent, one really exists.

The natural grasses are so numerous, that we do not perceive how they vary and succeed each other; but whoever has attentively examined a rich meadow, in which the grass is allowed to stand till the seeds are ripe, will find that every year there is some change; the grasses which were most abundant disappear, and others take their place: in time the first appear again and the rotation is established; which any one may be convinced of, by examining the hay made off the same land in different years. The fairy rings produced by a species of mushroom prove to demonstration, that the ground may be tired of particular plants, and refuse to bear them; but the richness of the grass in the ring proves also that the soil is not exhausted.

In the usual rotations adopted in Flanders it will be found, that all these circumstances have been taken into consideration; and as by a wise disposition of Providence, the bees, without reflection, are compelled by circumstances to build their cells strictly hexagonal, the very best form which a mathematician could devise for their purpose; so, by circumstances, men may be led to adopt the system of cultivation which is most advantageous on the whole, without any knowledge of the principles on which it is proved to be so.

To begin with the light sands. On the poorest spots, which are only just reclaimed from a state of barrenness, the principal object is to increase the active vegetable soil or humus; and the rotation must exclude those crops which greatly exhaust it. Wheat is out of the question, and potatoes can only be raised to be consumed on the spot. There must be something for the cultivator to live on, and this may be rye and milk. The first is raised by the help of manure; the second is obtained by growing clover and roots for the cows: these then are the basis of the rotation. Buckwheat will have a place, as it grows readily on poor light soils; carrots and turnips are indispensable for the cattle; and with a little help of manure, will grow well also. Here then are the materials for a rotation, which it only remains to arrange in the best manner. Mr. Van Aelbroek has given a very comprehensive table of the rotations and variations adapted to poor sandy soils; we will insert it here (see next page) as being a good authority; premising that, although it contains all the usual variations, it does not follow that every farmer adopts the whole rotation with all its varieties.

We have to remark on this table of rotations, that rye, with turnips sown after the rye is reaped, are repeated two years in succession. This appears against all rule, but the turnips come in between, and seem to recruit the land for a second crop of rye: and it must be remembered, that every one of the crops, excepting buckwheat, has more or less manure. Flax has commonly clover or carrots sown with it: turnips are mostly a second crop after rye or winter barley, a small proportion only being sown early. This rotation admits of considerable variety, and does not end correctly as it began; but the flax returns in the eighth, ninth or tenth year. Care is taken that there be no confusion; and where a crop is anticipated in the first course, allowance is made for it in the next. This table includes several different rotations, which may be followed singly; but the Flemings like to have a great variety of produce every year; so that the different rotations go on simultaneously. If the succession of crops is noticed in any particular field, it will be found that a very regular course has been pursued with regard to it.

TABLE OF ROTATIONS in a poor Sandy Soil.

First Year.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.
			Buckwheat.	Carrots.	Potatoes.	Barley and Turnips.	Flax and Carrots.		
			Oats.	Clover.	Barley and Turnips.	Potatoes.	Rye and Turnips.		
Flax and Carrots.	Rye and Turnips	Rye and Turnips.	Potatoes, Peas, and Carrots.	Oats, Rye.	Clover.	Rye or Barley and Turnips.	Ditto Oats and Potatoes.	Flax and Carrots.	Rye and Turnips
			Spurrey and Turnips.	Buckwheat.	Potatoes.	Oats.	Flax and Carrots.		
Flax.	Rye.	Clover.	Rye and Turnips.	Rye and Turnips.	Oats or Buckwheat.	Potatoes.	Rye and Turnips.	Flax.	Clover.
						Carrots.	Rye and Turnips.		
Flax and Clover.	Clover.	Oats, or Spurrey, or Peas.	Rye and Turnips.	Rye and Turnips.	Buckwheat, or Potatoes, or Carrots.	Barley and Turnips.	Oats.	Rye and Turnips.	Flax.
						Rye and Turnips.	Rye and Turnips.	Flax.	

In a soil of a better quality, which is a good light loam naturally adapted to bear wheat, or made so by assiduous cultivation, it is not uncommon to divide a farm into eleven equal portions, which are cropped as follows:—

$\frac{2}{11}$ In potatoes.
$\frac{2}{11}$ In wheat and turnips.
$\frac{2}{11}$ In oats and clover.
$\frac{2}{11}$ In clover.
$\frac{2}{11}$ In rye and turnips.
$\frac{1}{11}$ In grass left as long as it is good.

The rotation is kept regularly in the order here stated.

When flax is grown, the order is as follows:—wheat, rye and turnips, oats, flax, clover, rape, potatoes.

In this kind of land buckwheat is only sown when manure is deficient,

every other crop having some dressing or other. Mr. Van Aelbroek gives a more complicated table for the richest kinds of light soil. It is as follows:—

TABLE OF ROTATIONS FOR THE RICHEST KIND OF LIGHT SOIL.

First Year.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.
	Wheat.	Rye and Turnips.	Rye or Barley, and Turnips.	Potatoes.	Wheat.	Rye and Turnips.	Flax.	Clover.	
Flax and *Clover,			Potatoes.	Wheat.	Rye or Barley, and Turnips.	Oats.	Flax and Carrots.	Rye.	Clover.
or Carrots.	Oats.	Rye and Carrots, or Barley and Turnips.	Potatoes.	Wheat.	Rye and Turnips.	Barley and Turnips, or Oats.	Flax.	Clover.	
	Barley and Turnips.	Rye and Carrots.	Potatoes.	Wheat.	Rye and Turnips.	Flax and Carrots.	Oats.	Clover.	

* If clover is sown with the flax it is cut in the second year, and another year is added to the rotation; but it is more usual to sow carrots with the flax, and sow oats or barley the second year.

In this rotation two and even three crops of corn follow each other, which can only be excused by the intervention of turnips and the repeated manuring. In a farm of any extent a greater proportion of grass or clover must be sown to supply the manure required for the other crops: the potatoes are all consumed on the farm; wheat, rye, and flax, are the only produce sold.

When we come to the cultivation of the different crops separately, we

shall see what a quantity of manure is required in the Flemish system, a great part of which must be purchased, notwithstanding the quantity of stock which may be kept on the clover, turnips, carrots, and potatoes grown.

When the soil is sufficiently strong to grow beans, this useful crop is introduced as follows:—

1	2	3	4	5	6	7	8	9	10
Potatoes,	wheat,	beans,	rye,	wheat,	clover,	turnips,	flax,	wheat,	oats,
11	12	13	14						
fallow,	tobacco,	rye,	oats.						

This is a very long rotation in which a fallow is introduced in the eleventh year. Tobacco requires a good friable soil, so that this must be a very superior loam. In a stiff loam near Alost the following rotation is adopted:—

1 Potatoes, with 20 tons of dung per acre.
2 Wheat, with 3½ tons, and 50 barrels of urine.
3 Flax, with 12 tons dung, 50 barrels urine and 5 cwt. rape cake.
4 Clover, with 20 bushels wood ashes.
5 Rye, with 8 tons dung, 50 barrels urine.
6 Oats, with 50 barrels.
7 Buckwheat, no manure.

The quantity of manure used here appears extraordinary, and although the soil is called a stiff loam, it is by no means so in reality, for, from constant cultivation and manuring, it is more like a fine mellow brown garden soil. It seems rather too rich for buckwheat, but the oats will have reduced it, as the liquid manure only acts on the immediate crop, and leaves little behind.

In a rich loam at Vlamertingen, two miles west of Ypres, the following rotation is found:—

1 Turnips, carrots, chicory.
2 Oats and clover seed.
3 Clover.
4 Wheat.
5 Flax.
6 Wheat.
7 Beans.
8 Wheat.
9 Potatoes.
10 Wheat.
11 Oats.

This is the most scourging rotation of any, and proves a very rich soil; the manure however is not spared. Great attention to weeding can alone supply an occasional summer fallow. The potato crop and the flax help to keep the land clean. In the 1st, 3rd, 4th, 7th, and 9th years the land is manured.

On the rich heavy loams, the following is the Table of Rotations given by Mr. Van Aelbroek:—

TABLE OF ROTATIONS FOR A GOOD CLAY OR STRONG LOAM.

First Year.	Second.	Third.	Eourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.
Flax.		Oats.	Carrots or Barley and Turnips.	Wheat.	Rye and Turnips.	Potatoes.	Wheat.	Rye and Turnips.	Flax.
				Beans.	Wheat	Rye and Turnips.	Potatoes.	Rape and Carrots.	Flax.
	Clover.	Barley and Turnips.	Rape and Carrots or Beans.	Wheat.	Rye and Turnips.	Potatoes.	Rye and Turnips, Wheat.	Oats or Flax. Rye or Barley and Turnips.	Flax.
	Wheat.	Barley	Beans.	Wheat.	Rye and Turnips.	Potatoes.	Rape and Turnips.	Oats or Flax.	
		or Rye, and Turnips.	Oate and Clover or Potatoes.	Clover, Rape, and Turnips.	Wheat.	Rye and Turnips.	Flax.		
	Rape and Turnips.	Wheat.	Rye and Turnips.	Oats.	Clover.	Wheat.	Rye or Barley and Turnips.	Oats or Flax.	

Here is a great variety of produce, some of which, as rye, is more suited to a light soil; but the demand for rye, both for the distillers and for bread, determines the cultivation of it whenever it can be done. Wheat and rye occur twice in the course; potatoes and flax only once. Turnips as often as they can be grown after a crop of corn. Only a small proportion of beans are sown. This is owing to the smaller demand for this pulse, and also to the manner in which beans are usually sown, viz. broad-cast, which does not insure a good crop, although the closeness of the stems smothers the weeds.

From these specimens of rotations a tolerable idea may be formed of the general system. The mode in which each crop is cultivated will form the subject of the next chapter.

Chapter VI.

OF THE CULTIVATION OF RYE, WHEAT, BARLEY, OATS, AND BUCKWHEAT.

The general preparation of the soil for these different crops varies according to the season in which they are sown, and the crop which preceded. All except buckwheat are well manured at the time of sowing, and sometimes also during their progress towards maturity. The principle which pervades the whole system is to force the first vegetation, by which means a much smaller quantity of seed is required, and to supply the food necessary for the growth of the plant. The manner in which rye and wheat are put in will give an example applicable to every other grain.

Rye is everywhere a principal crop, as it forms a considerable portion of the food of the working classes in Flanders, seldom made into bread by itself, but mostly mixed with a portion of wheat, and sometimes with barley also. Rye is sown in light soils, as often as it can be done with any prospect of advantage; and, as it is found that a crop of turnips sown after rye harvest much repairs the soil, a second crop of rye is generally taken, as may be observed on inspecting the tables of rotations. But it must be remembered, that this second crop is well manured, and that with deep ploughing and ample manuring, land will produce a good crop of the same kind of corn much more frequently, than it would under less favourable circumstances.

When wheat or rye are sown after a white straw crop, as we call it, that is, after wheat, rye, barley, or oats—which can only be done with advantage under very favourable circumstances—the stubble is well harrowed soon after harvest, in order to pull up the weeds, and expose their roots to the sun. In the beginning of October from ten to fifteen tons per acre of good rotten dung are spread evenly over the land, and immediately ploughed in six inches deep: the land is ploughed in stitches or beds, varying from six to twelve feet wide according to the nature of the soil; the heavier soils are laid in the smallest stitches: liquid manure at the rate of ten hogsheads per acre is then poured into the intervals between the stitches, by means of a water-cart, which delivers it regularly, the horse walking in the interval. The harrows are now drawn across the stitches. This brings a part of the fine soil into the intervals, and prevents the too rapid evaporation of the liquid manure. Six pecks of rye, or of wheat, or two bushels of winter barley, are now sown evenly over the land. The manured soil in the intervals is first stirred by the plough going once up and down, as is done between rows of turnips in the Northumberland system, throwing the loose earth in a ridge in the middle. Men follow with shovels, and throw this earth over the seed, as is done with potatoes in lazy-beds in Ireland, and completely cover it. A roller is then passed over, if required; or in very loose soils, men tread in the seed regularly with their feet as the gardeners do. The small extent of the farms allows of this garden culture, which in large occupations would be impracticable; but the principle is the same, whether executed by manual labour or machinery. A stiff heavy soil is ploughed nine inches deep, immediately after harvest, and laid in narrow stitches; spits of earth are dug out of the furrows with the spade and placed regularly over the ploughed part, without breaking them, as was described before, and they are left in this state for several weeks till seed time, when lime is spread over the land at the rate of fifteen or twenty bushels per acre: the harrows level the lumps,

and mix the soil with the lime: five or six hogsheads of liquid manure are poured over this, and very little more than a bushel of rye or wheat per acre is sown; the earth from the intervals is then shovelled out, and spread evenly over the seed.

When wheat or winter barley succeeds potatoes, as is generally the case, the ground is not ploughed, but only harrowed across; the stitches are marked out by the plough, and the earth in the intervals is spread over the seed. About a bushel and a half is the greatest quantity of seed sown per acre. The average is five pecks. After rape, which is reaped early, there is time for a bastard fallow, which is not lost sight of. The land is ploughed, cross-ploughed, and laid in stitches, and then the wheat is sown in the same manner as before described. It must however be observed, that as potatoes and rape are very highly manured, no additional manure is put on for the wheat; but should its appearance in spring not be vigorous, the urine tank is resorted to, to supply the deficiency.

Great attention is paid to the choice of seed; the wheat is generally pickled or steeped in salt water, and dried by sifting lime over it before it is sown. Some scientific farmers use vitriol, arsenic, and various preparations, to prevent smut; but urine, salt, and lime are the most common, and seem to answer the purpose completely. The other grains are not usually prepared by steeping, but sown in their natural state.

There are several varieties of rye; but none appears to possess any decided superiority: of wheat there are many sorts, white and red: the white wheat which grows at Kalken, not far from Ghent, is in great repute for the fineness of its flour. It seems to degenerate in every other soil. We have seen a red wheat with a white chaff in one or two places, which bears a very great resemblance to some of the wheats lately brought into notice in England under various names. The common sorts both white and red appear full, and the straw strong and healthy: careful cultivation no doubt increases the produce and lessens the casualties from disease or climate. A mixture of wheat and rye is sometimes sown, which is called *meslin* in Yorkshire, and *meteil* in Flanders. It is asserted that, in a certain proportion, the two grains produce more when sown together, than they do if each be sown separately. Those who defend the practice maintain, that if the season does not suit wheat, it suits rye, and that between the one and the other a crop is secured. The adversaries assert, that rye and wheat ripen at different times, and that the wheat will be reaped too green, or the rye will be over-ripe and shed. But as pure wheaten-bread comes more and more generally into use, meslin is in less demand, and can only be used in the farmer's family. Wheat and rye separately are more readily disposed of in the market, and this will be sufficient to decide the question; accordingly meslin is but sparingly sown; where the land will bear it, wheat is sown instead: where it suits rye better, the latter is preferred.

Barley is considered as a grain of much importance in a country where the vine does not thrive, and where beer is the principal beverage. The variety preferred is that which is sown, like wheat, in autumn, and is called winter barley. In the rich soils of the polders, especially those which contain much silicious and calcareous sand in their composition, extraordinary crops of barley are sometimes raised, as much as ten quarters per acre, weighing from 50 to 56 lb. per bushel, and this induces the farmers frequently to sow this grain twice in succession, without any manure. The favourite sorts are called *Escourgeon* and *Sucrion*. They are sown in autumn and reaped in July. Spring barley is sown occasionally, but produces a smaller return, and the grain is lighter. Some Chevalier barley was sent

over a few years ago from England, which was heavier than any spring barley grown in Flanders. Its weight was 57 lbs. per bushel: whether it has increased and been extensively sown there, we have not had any means of ascertaining: new productions, or new methods, are not readily adopted by any farmers, and least of all by the Flemings. The advantage of spring sown barley is, that it gives time for feeding off turnips, and getting the land in good order for sowing. When the Flemish farmer shall have found out the advantage of folding sheep on turnips in winter, or as soon as the snow is gone, barley will be more generally sown in spring. There is in fact no specific difference between winter barley and spring barley, and they are readily transformed into each other. Some varieties are hardier, and stand the frost better; but they will all ripen in good time, if sown in spring. The Siberian six-rowed barley is very hardy, and consequently is preferred in England for autumn sowing, but its use is chiefly as early spring fodder for sheep, and it is seldom sown for a main crop; the small portion which is allowed to stand for seed, is merely to have a supply to sow again, or to be sold for that purpose. The Scotch bere is a hardy inferior sort, fit for exposed situations. The Sucrion is a flat barley with two rows of seeds, which stands the winter well. All barley requires a soil in which the roots can spread readily; the best preparation for it, therefore, in heavy soils, is potatoes, as they are usually highly manured and the earth is well stirred by repeated ploughings: when it is taken after wheat, it is most advantageous to sow it in spring, having given a good tilth to the land before winter, and another in spring. In this case a good manuring both solid and liquid is applied. In light soils carrots are sown among the barley, in spring, thus making the earth produce two crops at the same time, the first reaped in July, the second drawn in October.

Oats are frequently sown after clover, and sometimes after rye or potatoes, as suits the rotation. It is a grain that thrives in almost any soil, with a small proportion of manure, and when the land is enriched, gives a large return. The preparation for oats in Flanders begins by spreading dung over the clover ley, but in a smaller quantity than for barley. This is ploughed in before winter, with a shallow furrow, which is laid over flat, to accelerate the decomposition of the roots of the clover. Sheep dung is thought peculiarly good for this purpose. The land is ploughed deep in spring, not to bring the dung again to the surface, but to turn a coat of earth over it. Liquid manure is sometimes spread over the surface before the seed is sown, but not always. The crop seldom fails to give from six to nine quarters per acre from two bushels sown, which is not more than half the seed usually sown in England. When grass-lands are broken up, oats are the most productive crop without any manure, and two crops of this grain are frequently taken in succession, which, as we observed before, can seldom be profitable in the end, whatever be the immediate gain; but the temptation of two good crops, with little or no expense, is too strong to be resisted. Oats are sometimes reaped with the Hainault scythe and sometimes mown. From the length of the straw, which is the consequence of high manuring, it is thought most advantageous to tie it up in sheaves at harvest, to prevent the shedding of the seed, if it be taken up loose.

Buckwheat is a grain which comes in very conveniently to be sown in poor light soils, when the manure runs short. If the soil is rich, it runs to stalk, and produces a succession of flowers, and but little seed is brought to perfection; as it is a plant which will not bear the least frost, it has but a short period to grow and ripen its seed in; and if the growth is luxuriant, the vegetation of the stem is prolonged till the frost nips it. It is sown late in the season, and may be considered as a substitute for a fallow. The

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land is generally ploughed three or four times, and well cleaned, and the buckwheat is sown in the middle of May. It usually precedes potatoes or carrots, for which the repeated ploughings prepare the soil; and the buckwheat, by the shade of its broad leaves, smothers all the annual weeds. It is sometimes ploughed into the land in a green state, when manure is scarce, and then it is succeeded by rye or wheat; but this is not a common practice in Flanders, where manure can generally be obtained in abundance by the canals. Buckwheat is used for feeding poultry and pigs, and also for distilling. When it is ground, it produces a very white flour from which a pleasant cake, like a crumpet or thick pancake is made, which is much relished by the peasants.

Chapter VII.

OF THE CULTIVATION OF LEGUMINOUS PLANTS, PEAS, BEANS, TARES, AND GREEN CROPS, CLOVER, SPURRY.

Peas are cultivated on the light soils, but as is the case with buckwheat, they are only sown when the land is not thought sufficiently rich for other crops, and when there is a deficiency of manure; as little or none is given to the land for this pulse. They are generally sown broad-cast in the month of April, and the seed ploughed in: two bushels of seed per acre is the usual quantity. The ground is prepared by being ploughed once or twice in autumn, and again in spring, but less care is bestowed on this crop than on any other. When the plants are about four inches high, they are well hand-weeded; the produce is from twenty-eight to thirty-two bushels per acre. Neither peas nor flax are sown again on the land which has borne a crop of peas, in less than eight or ten years. The white pea, which is split for ship store, is preferred as the most valuable; but the grey pea for hogs is also common.

The cultivation of beans on the heavy soils, which alone are fitted for this pulse, is by no means so perfect as in England, especially in Kent. The broad-cast method of sowing prevents the use of the horse-hoe; and as a principal object in sowing beans in Flanders is to smother the weeds, they are sown so thick, that the hand-hoe is of little use. The manner in which the land is prepared is as follows: having been ploughed in autumn, and well harrowed to destroy the weeds, it is ploughed again very deep in March, and the stitches are reversed, the crown being where the interval was before. It is again well harrowed. and about three bushels of beans per acre are sown regularly by hand and harrowed in: after this ten or twelve tons of manure are put on evenly, or, if the soil is very heavy and cold, eight tons of manure and fifty bushels of lime. This is ploughed in with a very shallow furrow, only two or three inches deep, and then the land is laid smooth by passing the harrows reversed over it. Some farmers sow the beans after the manure is spread, and plough in both together; others plough in the manure first, and then sow the beans, and cover them with the harrows. This last method does not sufficiently cover them, and if the weather should be dry soon after sowing, the beans will not come up so regularly.

A few intelligent proprietors have seen the deficiency of this method both in the crop and in the state of the land after it, and have adopted another practice taken from the gardeners. A man with a strong hoe

like the Devonshire hack, makes holes in a line, at a foot or more from each other and women follow and drop two or three beans in each hole, which are covered with the earth scooped out of the next row of holes as the workman returns. The distance between the rows is the same as between the holes in the rows; and by making the holes in one row opposite the intervals of the other, the whole field is planted in a quincunx order, as is usually done with cabbage plants. There is a great saving of seed in this way of planting beans; and when the plants come up they are well hoed and weeded, and the earth is drawn up all around the stems. The produce is much greater, and the land is as clean as after a fallow. Another method where the land is sound and dry, is to spread the manure, and rake it into the furrows as fast as they are made by the plough; beans are then dropped on the manure and covered with the earth of the next furrow when the plough returns, till the whole field is planted. If this is done in every second furrow only, the crop will be all the better, and the land more easily hoed. Horse-hoes have not yet been introduced into practice; some such instruments have been brought from England, but they are mere objects of curiosity, and are despised by the ignorant. In heavy soils some of the best farmers trench-plough the land, by means of two ploughs following each other in the same furrow. This is most advantageously done before winter, that the frost may mellow the poorer earth brought up. A good liming and manuring soon bring the whole mass into a fertile state; and in this deep soil beans grow luxuriantly. In some districts where the soil is loamy, they sow peas and beans together, and sometimes tares also; the object is to produce green food for the cows and pigs in summer. In this case the closer the plants can be made to grow, the better for the land; as nothing cleans it more effectually. The crop is cut at the time when the pods are just formed, and while the top is still in bloom; it is used in a fresh green state, as tares are in England. If any extent of ground is devoted to this crop, portions are sown at different times to have a regular succession: it produces the heaviest crop of green food that can well be got from the land. This practice is worthy of imitation in our stiff soils. It seems not to exhaust the land, and leaves an admirable surface to sow wheat in with a single slight ploughing: or if it be thought advantageous, there is ample time thoroughly to pulverize the soil during summer and autumn.

Tares are occasionally sown for their seed like peas, but they do not enter into the usual rotations, and as the generality of soils are light, clover is preferred. In the heavy soils they are mixed with peas and beans for green fodder as we noticed above. A more extensive cultivation and succession of winter tares and spring tares, might afford a useful addition to the food for horses in summer; especially as clover cannot be sown with advantage on the same land oftener than every seven or eight years.

Clover is the glory of Flemish farming, and in no country is it found in greater perfection. It was from Flanders that the cultivation of this productive and useful plant was introduced into Great Britain. Sir Richard Weston, in an account of a journey into the Netherlands in 1645, speaks with admiration of the fields of clover he had seen there, when clover was not known in England as a cultivated crop, and only found amongst natural grasses in rich meadows. The large broad clover, commonly called red clover, (*Trifolium Pratense*,) is that which is chiefly cultivated in Flanders. This is sown in spring at the rate of 8 lbs. of seed per acre amongst the barley, oats or flax, or in the rye or wheat which were sown in autumn. When it is sown among flax, which is drawn without

injuring the clover, it is cut the same year. With barley it is apt to become too rank and impede the drying of that crop at harvest. In the second year the clover comes to perfection; it is then mown at least twice, but often three times in the season, furnishing a heavy green crop each time. The great use of clover for cattle tempts farmers to repeat the crop too often on the same ground, and the consequence is a failure, not only on account of the soil being deteriorated for this plant by the too frequent production of it, but also by encouraging a most destructive parasitical plant called the *Orobanche*, which in some places in Flanders threatened to put an end to the cultivation of clover. The minute seeds of this plant fix themselves to the roots of the clover, and vegetate at their expense. The plant affected becomes weak, and ultimately dies away, and the Orobanche spreads so rapidly, that whole fields of clover are soon destroyed, if the progress of it be not arrested in time: the only sure remedy is to keep the land in good tillage, and not to sow clover in it again for at least eight or ten years; if it be sown sooner the Orobanche will again make its appearance. This plant is known in England, but its devastations have never been so great as to lead to any public notice of it. It is easily discovered, rising several inches out of the ground, and the stem being of a peculiar scaly form.

In the spring of the next year after the clover is sown, it is almost universally dressed with Dutch peat-ashes, at least in the lighter soils. From thirty to fifty bushels are spread on an acre about the end of February: showery weather is favorable to their being washed to the roots of the clover. In strong soils the top-dressing often consists of the compost, which we have described as being collected in the croupissoir, which is rich and well mixed with lime. When weeds appear among the young clover, they are carefully pulled up at the time when the top-dressing is put on; and if the plants seem weak and thin, a sprinkling of diluted tank liquor invigorates the growth.

The greatest part of the clover is given to cattle in a green state, it being then most nutritive: hay is only made of any surplus quantity which could not be consumed in the season. This is usually made about the middle or end of June. In the making of clover hay, there is nothing superior to the methods used in England, excepting that small proprietors sometimes reap it and tie it in bundles, as is done with corn, especially if the seed be ripe: by this means the leaves are less scattered about, and in them is contained the principal nourishment of the plant. In order to have clover seed free from admixture with the seeds of weeds, women and children are sometimes employed to gather the heads of the clover, singly, when ripe: they collect them in baskets and carry them to the barn till they can be thrashed, which is usually done in dry frosty weather; because then the capsules are brittle, and the seed separates more easily from them.

The Waes country is that which chiefly supplies the market with clover seed; and Lokeren is the place where the greatest quantity is sold. Many farmers from other districts prefer buying this seed to saving their own.

The value of an acre of clover is very considerable. The first crop is often sold on the ground for 120 francs, nearly 5*l.* per acre, and the seed from the second crop, which in the Waes country frequently amounts to five or six cwt., may be worth there as much more, making the whole produce amount to 10*l.* with very little outlay. Taking the difference in the value of agricultural produce, this is fully equal to 15*l.* per acre in England, a sum which few crops of clover will realize here, when the expense of making the hay is deducted. When the clover-plant fails, the land is ploughed in

autumn, and some other crop is sown; or fresh clover seed is sown in the vacant places, in the following spring, and the bush harrow or the traineau is drawn over to bury it: by this means a good crop is often secured by the end of July.

Spurry,—*Spergula Arvensis*—is a plant which grows very rapidly in light sandy soils. It is often sown immediately after barley harvest to be cut in time for the sowing of rye. The produce is trifling, but it costs little, and cows are very fond of it. It is said to give their milk and butter a very agreeable flavour. Ten or twelve pounds of seed are sufficient for an acre. A variety much larger and more productive than that which is a mere weed in our light soils is sometimes sown in the end of March, and, with the help of liquid manure, produces a tolerable crop in less than two months; after which a crop of potatoes may still be had, or at least, a very good crop of turnips. This is sometimes a convenient way of bringing a field into a regular course again, when, from some circumstance or other, the usual rotation has been disturbed.

Lucern, which is so highly prized in some countries, is not cultivated to any great extent in Flanders. The poor light sands are not very favourable to this plant, which likes a rich deep soil. In western Flanders there are some soils well adapted to its growth, but it is not so common as to form any marked feature in Flemish husbandry. Barley is sometimes sown to be mown green in spring; but rye, which is chiefly sown for that purpose in England, is seldom cut green. This arises probably from a reluctance to cut down a plant, which, when it comes to perfection, produces the principal food of the people. That this is no sufficient reason the slightest reflection will convince us: for rye cut in a green state does not exhaust or deteriorate the soil, as it would when left to ripen its seed, and it may therefore be sown again on the same land without waiting the usual time allowed for its recurrence. The question is simply as to the value of the seed sown when compared with that of the green crop.

Buckwheat is sometimes cut for fodder in the light sands, and helps to make up for a deficiency of clover.

Chapter VIII.

OF THE CULTIVATION OF ROOTS, POTATOES, TURNIPS, BEET, CARROTS, PARSNIPS, CHICORY.

If we are indebted to the Flemish for the introduction of clover and turnips into our agriculture, they are equally so to us for the valuable potato. This root is now become a great substitute for corn throughout all Europe, and its influence on the population cannot be denied; when corn fails potatoes are generally most abundant, and thus prevent that distress, which is so great a check to population. In Flanders potatoes form a part of every rotation, the light soils being peculiarly adapted to the growth of this root; and as a great part of the produce is consumed by cattle, and thus gives an adequate return in manure, the objection often made to its extensive cultivation, that it exhausts the soil and returns little to it, is not well founded. Were it not for potatoes to keep the cattle, during the latter part of the winter and beginning of spring, when the supply of turnips fails, a much smaller number could be kept; for hay is a dear fodder in most parts of Flanders.

Potatoes were at first only known as an esculent root in gardens; and it was a long time before their real value was found out. In 1740 they were for the first time sold in the market of Bruges, in consequence of the zeal of an individual of that town, Mr. Verhulst, who distributed some sets gratuitously to the farmers in the neighbourhood. From that time the cultivation increased rapidly, and spread all over the country. The varieties which are mostly sold in the towns are the earliest and best flavoured, which are chiefly raised in sheltered gardens. The plant being a native of a warmer climate cannot bear the least frost. It is therefore not safe to plant it in the fields before March or April. The sets which are planted to produce an increase, are not seeds but buds, and as such perpetuate the qualities, good or bad, of the parent stock. Each variety proceeds from some original plant raised from seed, and is subject to age and decay with its parent. Hence varieties continually degenerate or wear out, and fresh or new varieties must be produced by sowing the seeds: recent experiments and observations fully bear out the truth of this assertion. It is therefore not sufficient merely to find a superior variety, the age of the parent plant should also be noted. Some will last longer than others, but all old varieties sooner or later show marks of decay; and the sooner they are exchanged for younger and more vigorous the better. In Flanders the principal crop of potatoes is planted in April. Potatoes require much manure to give a great return, although those which grow in poor soils are much pleasanter to the taste. For cattle, however, quantity is of more consequence than flavour. The soil in which potatoes are to be planted should be well prepared by deep and repeated ploughing, or what is still better, by trenching with the spade. In Flanders the sets are planted in rows two feet wide or more, and the same distance between the sets, so that each plant may have the earth drawn up to the stem, and a small hillock made round it. Sometimes the land is ploughed and manured as for other crops, excepting that the quantity of manure is at least double the quantity usually put on for corn. The sets are then dropped into holes regularly made with a blunt dibble, and filled up with earth. These sets are either small potatoes picked out for that purpose, or larger cut into pieces, taking care that there shall be at least two eyes or buds left in each piece. When potatoes are planted to any considerable extent, the method is similar to that which we described for beans, the furrows being proportionably deeper; the sets are dropped upon the dung in every second or third furrow about eighteen inches apart, and covered by the return of the plough. In this manner nine or ten bushels of potatoes will plant an acre. The crop averages about three hundred bushels, if the land is well prepared, and the potato-plants have been well hoed and moulded up. This is not a very great return, considering the quantity of manure. The quality of the potatoes depends on the nature of the soil as well as on the variety planted: in light sands the potatoes are small, and mealy when boiled; in good loams they grow large and more juicy, but are not so well flavoured; the latter producing a greater bulk, are preferred for cattle.

There is a potato called *Schelde Windeke* potato, from the name of a village near Alost: they grow in a strong soil and are remarkably mealy and good; but they rapidly degenerate when planted in a different soil. The potatoes which are preferred for cattle are called *Elsen Motten* and *Katten-bollen*, both very large. A variety was introduced from England into the neighbourhood of Ghent some years ago, by a gentleman of the name of Lankman, which are in great repute, and go by his name. It would be difficult to point out the variety from which these sprung, as the soil in which they are transplanted has, no doubt, had a great influence on

their present quality. A few small Flemish potatoes, which we once sent to a friend at Kenilworth, produced in that rich soil some of the largest potatoes we ever met with. None of the original potatoes were so large as a hen's egg.

When we were on the subject of manures, we mentioned the pond weeds as highly useful in planting potatoes. Long litter and even old thatch is excellent to plant the sets in, if the soil is not very light. Potatoes are usually taken up in the end of September; this is done by means of a three-pronged fork, which is less apt to cut the roots than the spade. The ground is at the same time cleared of the roots of coutch grass, and other perennial weeds; and when the harrows have gone over the field, and all the potatoes are picked up which had escaped the fork, no other preparation is required to sow wheat, or winter barley. When the seed is sown, the stitches are marked out by the plough, the intervals dug out, and the earth is spread over the seed, after the urine cart has deposited half the usual quantity of liquid manure in these intervals. This is sufficient on land which has had a double manuring for the potatoes.

Turnips are not often cultivated as a main crop, or a substitute for the old fallows, as it is in England and Scotland; but mostly as a second crop after barley or rye, which we call *eddish turnips* in England. But as the barley and rye harvest are early in Flanders, and not an hour is lost in getting the turnip-seed sown, they are often of a very good size before winter *. The crop however can bear no comparison, in point of weight, with a turnip crop in Norfolk, still less in Berwickshire and Northumberland; but it is obtained at a small expense, and does not interfere with any other crop. In a farm of twenty acres, if five acres were set apart every year for turnips, the remainder would scarcely give sufficient occupation to the farmer and his family, and produce sufficient corn to feed them and to pay the rent. It is by the quick succession of crops that a small farm is made to produce much more in proportion than a large one, and that every member of a family is constantly and busily employed. As soon as the corn is cut, the portion of the field which is cleared is ploughed and harrowed, liquid manure is poured over it, and the seed is sown; so that in twenty-four hours an acre, which was but just cleared, is again producing a fresh crop. The ploughing and sowing goes on every day, and follows on the heels of the reapers: of such consequence may be the delay of two or three days, that the seed sown first will be out and in the rough leaf, when that which was two or three days later is only just coming up, and is subject to all the depredations of insects. When the turnips are fairly up, they are watered with diluted urine; and their growth is rapid beyond belief. We have seen turnips sown in the middle of July, after barley harvest, which in the end of August already showed very promising bulbs. If it were not for this acceleration of the growth, no crop of any weight could be raised by the end of September, when they are usually pulled up.

The cultivation of the beet-root had been introduced into Flanders under the dominion of Buonaparte, for the manufacture of sugar: it was then a

* Mr. Van Aelbrock sowed some turnips in May, 1837, and they were of sufficient size in August to be given to the cows. Large turnips are not thought so sweet as the smaller, which do not give that disagreeable taste to the milk, which prevents many farmers in England from giving them to the milch cows.—The introduction of early turnips in Flanders might be of great advantage. If winter tares were sown to be cut in May, and turnips to follow immediately, these two crops, with the intermediate ploughing, would prepare the land admirably for wheat or colza, and not only give two useful crops, but have all the meliorating and cleansing effect of a fallow.

forced cultivation, and was abandoned as soon as peace had restored the usual supply of sugar from the colonies; and although the revival of this manufacture in France, where considerable fortunes have been lately realized by it, has induced several speculative individuals, and also a company with a large subscribed capital to re-establish manufactories of beet-root sugar in different parts of Belgium, the Flemish farmers in general are not much disposed to raise the beet-root for sale. They imagine, whether correctly or not, that the land suffers from this crop, when there is no return of manure, as much as it would from potatoes sold off the farm, while the latter are much more profitable: and the carriage of this heavy produce to any distance through roads almost impassable in autumn greatly diminishes the return. The manufacturers of sugar have found, in consequence, that they cannot rely on a regular supply from the farmer, and that they must enter into the cultivation of the beet-root to a large extent on their own account, to keep up a proper supply. The company established near Waterloo have purchased a large tract of land, a great part of which is in woods, which they are cutting down and converting into arable land for this purpose; on this fresh soil, which is by no means rich, the beet-root appears to thrive well. A large sugar manufactory is erected at Bruges, another near Ghent, and a smaller near Dixmude, and various other places, which will require many hundreds of acres for beet-root annually, and thus make this root an important article of cultivation. The mode in which this root is cultivated has nothing peculiar in it. The land is ploughed and well manured; the seed is dibbled, as in the garden, in rows a foot or eighteen inches wide and a foot asunder in the rows; when the plants are up they are weeded and hoed by hand; the seed is put into the ground in the beginning of May, and the roots taken up in September and October. A common crop is from fifteen to twenty tons of roots from an acre of land.

This cultivation has not been adopted for a sufficient number of years to ascertain what rotation is most profitable, where beet-root is the principal object. Those who are sanguine think that alternate crops of beet-root and corn may be kept up by good tillage and manuring. The old farmers are of opinion that there will soon be a great falling-off in the crops. Time will show who are right. In the mean time the cultivation of the white and yellow beet, which contain most saccharine matter, is extending rapidly. A small portion only of these useful roots is raised for the cows. They are not supposed to be so good for the milk as turnips, and they take up the whole season. Should the cultivation be greatly extended, it may have a great effect in causing a variation in the usual rotations of crops, now generally adopted. The advantage to agriculture of the beet-root sugar manufactory, where good land is not over-abundant, is still problematical.

The *Ruta-baga*, or Swedish turnip, which is so highly valued by the British farmer, is not generally cultivated in Flanders. If a few small patches of it are seen, it is only as an experiment made by some rich proprietor. It does not enter into the regular system of cultivation, and is not so well suited to sandy soils as the turnip.

Carrots grow well in light soils, which have been trenched to a good depth, and they consequently form a part of the regular rotations in all light soils: when they are sown as a principal crop, it is generally next after potatoes, buckwheat, or turnips. The land, having been well stirred for these crops, is ploughed before winter, and manured with half the usual quantity of cow dung, or of the sweepings of streets, with which is mixed a third part of pigs' dung, from the notion that the smell of this dung

keeps off the moles and field mice, who otherwise would injure the crop. This is ploughed in six or seven inches deep, and the land is left so all winter. In the beginning of April a very deep ploughing is given, two or three inches deeper than the last: twenty hogsheads of liquid manure are then poured over this, and 2½ lbs. of carrot seed are sown. The harrows reversed are drawn over the land; the intervals between the stitches are dug out with the spade, and the earth thrown evenly over the seed. It is then slightly rolled. Some put on no dung, but only liquid manure, on the land intended for carrots. If the preceding crop was potatoes, the ground is already sufficiently manured, and any additional quantity would have a tendency to produce furked carrots, which is the consequence of over manuring: but if they follow buckwheat, which has had no manure, a fresh supply is necessary to ensure a good crop of carrots. The more the manure is decomposed and intimately mixed with the soil, the better for this crop. When the carrots come up, they require to be most carefully weeded: this is the principal expense. It is done by women and children, who go on their hands and knees and pull up every weed. If carrots were sown in drills much of this labour might be spared, by using horse-hoes between the rows, and small hand-hoes between the plants in the rows. Should the carrots fail, turnips or spurry are immediately sown, that no time may be lost. In May the carrots are thinned out where they grow too close, and those which are pulled out are given to the cows; they are left about six inches apart.

There are two sorts of carrots sown in the fields; the one is the large Dutch orange carrot common in England, the other is a white carrot which is very hardy, grows to a great size, and is more productive in light sands than the orange. It has lately been introduced into England: some fine specimens of the root were exhibited at the Smithfield show in December 1836. From a trial on a small scale, we are inclined to think that it will be a valuable addition to our roots for cattle in winter. The white carrot is that which is generally preferred for sowing in another crop, as flax or barley, which is a cummon practice. In this case the carrot seed is sown a week or two after the principal crop. The flax or corn grows faster than the carrot, which is thus kept down, and only pushes its slender root deep into the ground without making much top, or swelling to any size. In weeding care is taken not to pull out the carrots, which are easily distinguished from weeds. After the flax is pulled, the ground is gone over and weeded again; liquid manure is then spread over, and the carrots soon begin to grow, and the roots to swell. If the main crop was barley, the stubble is carefully pulled up, and the carrots are then treated as before. Thus by the middle of October a good weight of carrots is produced on land, which had already given a profitable crop that season; and a great supply of winter food is obtained for the cattle. Carrots are occasionally sown amongst peas. The peas ripen in July, and are pulled up; and then the carrots are treated as we have been describing. If the row culture were introduced, and the carrots and peas drilled in alternate rows, the success would probably be more complete. This is done in the intervals of the colza or rape with good success. About fifteen small cart-loads of carrots, or about ten or twelve tons per acre, is considered a fair crop. Judging from the produce of about one-eighth of an acre of good sand, in which the white carrot was sown in England, in March 1836, without manure, the rows a foot apart and well weeded and hoed, the crop would have reached twenty-two tons per acre: the common orange carrot in the same ground did not produce half that weight.

Parsnips are sown in land too heavy for carrots; and in a deep rich

loam, the produce is very great. They have the advantage of bearing the severest frost, and therefore do not require to be housed, but may be left in the ground until they are required for use. They are not thought so good for milch cows as carrots, but superior for fatting cattle. The quality of the soil must decide which of the two may be sown to most advantage.

There is another root, the cultivation of which is often very profitable, although of comparatively small use on the farm. This is chicory, of which the dried roots are roasted and used instead of coffee. A considerable commerce in this root has sprung up lately, which has caused a duty of 20*l.* per ton to be laid on its importation into Britain. It is the same plant which Arthur Young so strongly recommended for its leaves for cattle and sheep; but it has not been found to answer the expectation in this point of view. The root contains a strong bitter, which may be extracted by infusion; it is also used in the brewing of beer to save hops. It is wholesome, and if it does not impart an unpleasant taste to the beer, there can be no objection to its use. At all events the cultivation of it, whether for beer or coffee, is a part of Flemish agriculture, and deserves to be noticed. The seed is sown in the end of March or beginning of April. It is treated exactly as the carrot, when sown alone. The ground should be mellow and deep, rather heavy than light, and ploughed or trenched to a good depth. It is sown broad-cast in Flanders, as everything else is; but it would be much better if it were sown in rows eighteen inches apart. The leaves may be given to sheep or pigs; but they give a bad taste to the milk of the cows who eat them. The roots are taken up in September, and are then of the size of a small carrot: they are cut into pieces, and dried in a kiln. In that state they are exported. The price varies much, according to produce and demand. It is not an object of general cultivation, but only by particular persons and in particular soils: the market is overstocked at one time, and a great demand exists at another. Such a produce can never enter into a regular course, but may be raised as circumstances may afford a prospect of sale and profit.

Chapter IX.

OF THE CULTIVATION OF FLAX AND HEMP.

Flax may be considered as a staple commodity in Flanders; it employs a great portion of the population, is exported in large quantities, and the cultivation and preparing of it is most perfectly understood there. It may be raised in various soils, but its quality depends much on the land chosen for its cultivation, and on the tillage and manuring. Its roots sink deep, where it has room, and it is generally said, that the roots of good flax should strike into the soil to a depth equal to half the length, at least, of the stem above ground. The soil most proper for this plant, if there is a choice, is a deep, rich, friable loam, neither too dry in summer, nor wet in winter, in short, the best and deepest soil that can be found: but as this is scarcely ever to be obtained to any great extent, art and labour must supply the deficiency of nature; and trenching, working, and manuring must create a deep soil and enrich it. A porous subsoil, or one that is well drained is essential. In a course, or rotation, in which flax enters as a principal crop, the whole management of the land should have a reference to the flax to be raised. In the three tables of rotations which we have given on the autho-

rity of Mr. Van Aelbroek, it may be observed, that each begins with flax and ends with flax; and there is no doubt that the arrangement of the crops is much influenced by the preparation of the soil required to bear a good crop of flax at the end of the course. For this purpose a surplus of tillage and manure is given to each crop, so that the soil is deepened and ameliorated at each successive step, and is brought to as perfect a state as it will admit of by the time the turn comes to sow flax. This may remove the surprise which is naturally excited by the amount of tillage and manure given for each crop, which appears, at first sight, far greater than can be required. The quantity of liquid manure poured over the light lands year after year, cannot fail to make them rich, and the frequent trenching with the spade, must, in the end, transform the whole soil, to a considerable depth, into a compost of rich vegetable and animal matter intimately mixed with the natural earths. It is, in fact, an accumulation of humus, which is the best preparation to ensure a good crop of flax. It is not, therefore, to the immediate preparation of the soil for the flax, that its abundance or good quality is to be chiefly ascribed, but to a gradual system of amelioration, which has brought the soil into the high condition required for this plant.

The finest flax is raised in the neighbourhood of Courtray, where the soil is naturally of such a quality as flax requires. In other districts the soil requires more care and culture, to make it produce anything approaching to the quality of the Courtray flax. In some, as in the Waes country, and more especially in the neighbourhood of Ghent, no exertions or manuring can produce flax which will bear any comparison with the best: but they produce very good crops of flax notwithstanding, of a moderate quality; and they find it a profitable crop, which to the farmer is always an important point. If it were not for a course of continual improvement of the soil, they never could raise such flax as they now produce; nor would any sort or quantity of manure put into the land at the time the flax is sown, produce so large, or so good a crop as will grow in land gradually and properly prepared. It is necessary to premise this, in order to prevent disappointment when attempts are made to imitate the Flemish methods. If any one will follow the whole course on a similar soil, the result will probably be the same.

The crops which immediately precede flax in light soils are barley, or rye, with turnips after them the same year. In this case these crops are more highly manured than usual, and the turnips have a double quantity of liquid manure. About Christmas, the turnips being taken off, the land is ploughed into high ridges, and the intervals dug out: it remains in that state secure from wet and exposed to the winter's frost. As soon in spring as the weather permits, the land is again ploughed and well harrowed, to let the seeds of annual weeds vegetate. A month after, another deep ploughing and harrowing are given to bring the land into good tilth and clean it well. Peat ashes are now put on at the rate of thirty bushels to the acre, and these are spread and harrowed in; a few days after ten hogsheads of strong liquid manure,—the emptyings of privies is preferred—is poured regularly over; and thus it is left for a week or ten days, that the manure may soak in. The seed is then sown: the quantity varies, but is always very abundant, 160 lbs. are generally sown on an acre. The seed is slightly covered by a bush-harrow or the traineau drawn over the land: more than half an inch of earth over it would prevent its vegetating. Cloudy or showery weather is chosen for sowing it, as a very hot and dry air might also prevent its rising. The best seed is imported from Riga. The first crop of seed raised from the Riga seed is sometimes used, but it

is supposed to degenerate fast; and the home-raised seed is said to produce coarse branched flax. This, however, is maintained by others to be a mere prejudice; and it is recommended to sow a spot thinly, aod give the plants room to grow and perfect their seed. The flax of these plants will be much inferior, but the seed will be good and plump, and equal to the Riga seed for sowing. The question arises still, which is the cheapest method, to raise seed thus, or to import it; this is a matter of simple calculation, and we must leave the flax growers to decide it.

About Courtray the method is somewhat varied, the flax is sown earlier; the soil being peculiarly suited to this crop, less preparation is required. The preceding crop, which is frequently colza or oats, receives a double portion of manure: some very rotten dung is ploughed in with the stubble, and is completely decomposed during the winter. Early in spring the ground is ploughed and harrowed across; liquid manure is poured on as before, and the seed is sown. The quantity and nature of the manure depends on the state of the soil as to fertility, especial care being taken, that no hot dung be used, and nothing which by any chance can increase weeds. Rape cake dissolved in urine, or ground to a powder, is a favourite manure. Six hunderd to one thousand rape cakes, and one thousand gallons of urine, are often put on an acre of land on which flax is to be sown. It is an essential condition, that previous to sowing the flax-seed the land be quite clean and free from weeds.

Clover-seed or carrots are often sown amongst the flax; but many careful cultivators allow of no mixture, or anything to divide the juices of the soil with the flax. It is evident that in ground so highly manured the carrots or clover cannot fail to grow well; but they are weeds as regards the flax, and therefore it is thought, that they should not be allowed to grow amongst it. The next operation is to weed the flax, as soon as it is a few inches high and can be readily distinguished from the weeds. This is done by women and children, who from custom delight in the work: they go in parties, and generally work cheerfully together; with coarse cloths tied round their knees, they creep along on all fours, which injures the young plants less than if they walked; they go against the wind, in order that the plants, which are laid flat by their creeping over them, may be blown up again into an erect position, as soon as they have passed over. This proves what minute attention is paid to every circumstance which can possibly affect the crop. When the ground is quite clean, and the flax is grown to a good height, preparations are made for pulling it. The fibre is in the best state before the seed is quite ripe, and if this alone were the object, the flax should be pulled without waiting for the seed to ripen; but then the seed is valuable for the oil it contains, and forms an important item in the value of the crop. These advantages are to be balanced; and the flax is generally allowed to stand till most of the seed is ripe, or nearly so. Much judgment is required to ascertain the exact time, when there is a maximum of value, and each grower solves this problem for himself.

When the flax is pulled, it is laid on the ground in small parcels to dry. As soon as the capsules which contain the seed become dry, and break readily on being pressed between the finger and thumb, they are taken off by drawing the flax through a rippling machine, which is a kind of comb with blunt iron teeth, which separates the capsules from the stalk; and they are saved in bags or baskets. The flax deprived of the seed is now tied in small bundles, and, in some places, immediately put into the water to steep; but about Courtray, where every process is carried on in the greatest perfection, and where steeping flax is a distinct trade, the flax is placed upright in rows as soon as it is pulled, the root end spread out, and the tops resting

against each other in the form of the letter A, or the rafters in a roof; they do this so skilfully, that the rain has little effect upon it, and, unless it blows very hard, the wind does not overturn it. In a week or ten days, if the weather is dry, it is collected into thick bundles, of 8 or 10 lbs. weight each, and firmly tied. In this state it is stacked in the field, or deposited in a barn. The seed is beaten out at leisure in winter, and the flax is not steeped till the May after.

The method of steeping is the same at whatever time it be done, and the following is the common process. A piece of water over which alders grow is chosen in preference, as the leaves of that tree steeped in the water give the flax a peculiar tint, which is thought desirable; or if such a place is not at hand, alder leaves are sometimes tied up in the bundles of flax. It is thought that the alder leaves also drive away insects, which injure the fibres of the flax while steeping. The best and most experienced steepers, however, disregard these notions, and prefer the clear soft water of the river Lys, which they confine in long ponds made for the purpose along the side of the river, of such a depth that the flax may stand nearly upright in them without touching the bottom. This requires a depth of five feet or more. If they cannot be made so deep, the flax must be placed in a slanting position in the water, the root end lowermost, and the upper end a little under the surface of the water. It is kept in this position by means of mats spread over it; and poles with stones placed on them keep the mats down and the whole under water. If the steeping takes place in August the fibres will be sufficiently loosened from the woody parts of the stem in a week. In October it will take double that time, more or less according to the temperature. The warmer the air is the sooner the flax will be steeped. In May it takes somewhat less time than in October; and the flax steeped then comes out of a lighter colour than that which is steeped while green.

Some steepers tie the bundles together in pairs, the root end of one to the seed end of the other, so that half the flax leans upwards in the water and half downwards: but there seems no good reason for this practice, for, as the root end is sooner steeped than the upper, it will be unequally steeped, even if the flax be laid horizontally in the water, which is not thought so good as placing it vertically or nearly so. But as these men have great experience in the process, we must hesitate before we blame a practice of which we do not immediately see the advantage. Those who steep the flax in the Lys itself, collect it in thick bundles nearly a foot in diameter, and somewhat longer than the flax, by laying several small bundles together, as described above. In these large bundles the roots project at each end, and the tops are inside. They are tied round very tight in two places, about six inches from each end. They are then placed upright and closely packed in a cage, or open frame, made of wood and laths, ten feet square and four deep: boards loaded with stones are placed over the top, so as to sink the whole a few inches below the water of the river. Thus the water runs over and under the frame, and is continually changed. The consequence of this is that the flax becomes of a clean white colour, without the usual bluish tint, and is therefore more valuable. The time of steeping is somewhat longer than in stagnant water. It is pretended by those who do not adopt this method, that there is a considerable loss in the weight of flax steeped in this way, which counterbalances the superior value. This is however not clearly proved, and the quantity of flax which is brought from a great distance to be thus steeped, is a presumptive proof that this method is, on the whole, the most profitable, and the best.

The flax is frequently examined, when it is nearly steeped enough: if

it be left a few hours too long in the water, the quality is injured; and if it be taken out too soon, the whole fibre will not be detached, but will break in the scutching. As soon as the fibres separate from the woody part, the whole length of the plant, it is immediately taken out of the water, the bundles are untied, and the flax is spread out to dry on a piece of short grass, the place having been previously well swept, that no earth or dirt may be on it. In rainy weather this process is deferred; as rain would now injure the flax materially. It remains on the grass, ten or twelve days, and is frequently turned over during that time. It is then housed, and in the course of the winter it is scutched and heckled, operations which not being necessarily connected with agriculture need not be described here.

The capsules containing the linseed, which were separated from the stems before they were steeped, are spread on cloths in the sun, to thoroughly dry them; after which they are stored in a dry granary, until the seed be wanted for crushing, or for sowing. The seed which is beaten out in winter is better than that which has been separated from the capsules at first, because it has had time to ripen, and to convert more of its mucilage into oil. The Flemish flax seed, when sown, produces more seed than that from Riga, but the flax is inferior. Hence fresh Riga seed is bought every second year. Next to Courtray, for the growth of good flax, are Roulers, Thielt and Oudenarde; the Waes district comes next, with Termonde and Alost: that from the neighbourhood of Ghent is inferior.

An acre of good flax near Courtray is worth from 20*l.* to 25*l.*, without reckoning the seed, which is worth 5*l.* or 6*l.* more. Merchants come out of France and Brabant to buy it, as it is pulled and tied in bundles. They have it steeped at their own expense by the regular steepers. In other districts the flax is of less value; in some not above half this sum. When it is considered, that wages are not much more than half of what they are in England, it will be seen that the rent and profits of an acre of land fit for the growth of flax must be considerable; but it must be observed, that this golden crop only recurs every nine or ten years; and the continual manuring of the land must in part be set off against this crop, which some how or other considerably reduces the fertility of the land.

Hemp is not cultivated so extensively as flax, but as it forms a principal produce in the Waes district, where there are some considerable rope and cable manufactories, and is cultivated with some care, it cannot be passed over. The best soil for this plant is a good deep loam, such as is found in spots in the Waes district, and near Alost. The hemp raised on this soil is long and of a strong texture, and consequently well adapted for cables, cordage, and strong canvas for sails. In lighter soils the hemp is sown thicker, and does not attain the same size or strength.

The soil on which hemp is intended to be sown is ploughed in autumn, and again in spring. In the middle of May it is manured with fifteen tons of good rotten dung, which is immediately ploughed in, unless the land had been manured in autumn, which is the better practice, as then the dung is already in a decomposed state at the spring ploughing. In some small farms the hemp-land is trenched and prepared with the spade, and it amply repays the additional expense. In either case the liquid manure is not omitted, especially if *vidanges* can be procured: five tubs of this last, each as much as a horse can draw on the land, are considered as good a dressing as fifteen hogsheads of the common tank liquor, which is chiefly cows' urine. This manure is allowed to sink into the soil for three or four days; the land is then harrowed, and about half a bushel of hemp seed is

sown per acre. The seed should be heavy, shining and dark-coloured, and of the preceding crop: in three or four days the plants make their appearance, and soon after this they are carefully weeded and thinned out by hand. In very good soils, and where strong hemp is required, the plants are left six inches from each other. The strongest plants are pulled up in preference, as the male plants, which produce no seed, appear first. The names of male and female, as applied to the plants of hemp by botanists, are usually inverted by the hemp growers. They call that which produces the seed the male plant, and that which is barren the female. These names were no doubt used before the sexual system was well understood; but we shall call that the female which bears the seed. The male plants arrive first at maturity, at the time when the flower sheds the pollen which impregnates the female. They should then be gathered, as they would wither and become useless, if left till the seed was ripe on the female plants. This taking out the male plants does good to those which remain; and in order that this may be done without breaking the females, the seed should be sown in narrow beds with paths between them. From this circumstance arises a practice of sowing hemp in a border all round a garden or potato-ground, or in rows, with potatoes between them.

When the female hemp is fit to be pulled, the plants are drawn out of the ground with the roots, and tied in small bundles about six inches in diameter. These are placed against each other in a circle, the heads forming the apex of the cone. If the weather should be very rainy while they are in that state, the heads are sometimes protected from the rain by a covering of straw; but this is not a common practice. If the weather is fine the whole is sufficiently dry in a week or ten days; the seed is then taken off by means similar to those employed for flax, and the hemp is steeped.

The female hemp requires the least time for steeping: a week or ten days in the water is sufficient to make the fibres separate from the wood. If a much longer time is required, it is a proof that the hemp was either pulled too soon, or allowed to stand too long.

Rye or wheat is usually sown on the land which has borne a crop of hemp. Sometimes turnip-seed is sown amongst the hemp when the male plants are pulled up; but this is scarcely worth while, and the return seldom repays the trouble. Before the whole crop is pulled, if that takes place in September or October, the rye or wheat is thrown amongst it; the pulling of the stems covers this seed, and no other tillage is required. A slight application of the liquid manure soon makes the corn spring up; this saves ploughing and harrowing.

The produce of an acre of hemp in Flanders is about 350 lbs. of hemp, and from thirty to thirty-five bushels of seed, if the soil is good and well cultivated. It is not usual to sow hemp repeatedly in the same ground, as is done in many other countries, and also in parts of England, where a hemp land is a name given to some enclosure near the farm-house, which from time immemorial is the only spot where hemp is ever sown, The Flemish farmers have no hemp lands; and they seldom sow this crop again in the same spot in less than eight or ten years. Hemp requires so much care and manure, that it is not a favourite crop: it clears the land from weeds, and is a good preparation for wheat; but flax is upon the whole more profitable, and therefore preferred.

When the hemp has been steeped and dried, the fibres are separated from the wood by hand, or by a mill which crushes the woody part. This mill consists of a stone of a conical shape revolving on another circular stone laid horizontally, as in a cider-mill; the wood is thus broken and after-

wards easily separated from the fibre by beating and combing; but it is more commonly separated by hand; and the hemp thus treated is preferred. It is an easy employment for old people and children, by the winter's fire, or in a summer's evening; but it is too tedious to answer on a large scale.

Chapter X.

PLANTS CULTIVATED FOR THEIR OILY SEEDS, SUCH AS COLZA, NAVETTE, POPPY, AND CAMELINE.

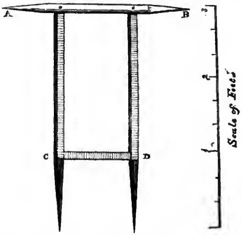
Besides the seeds of flax and hemp which are crushed to obtain the oil which they contain, there are other plants which are raised for this sole purpose. These are mostly varieties of the Brassica family, at the head of which stand the colza or *Brassica Campestris*, and the Navette, or *Brassica Napus*, both of which are sometimes confounded under the common name of *rape* in England. Almost all the seeds of the cruciform plants contain oil which may be expressed to advantage, and so do the kernels of most nuts, and the stones of fruits.

The colza is a plant which requires a good, and rather strong soil, as well as a careful cultivation. In Flanders it enters into the regular rotations on all good heavy loams, and is thought an excellent preparation for wheat, as may be well supposed, when it is considered how the soil is tilled for this plant, how much it is manured, and what care is taken to keep it clear from weeds.

In the polders, where fallows are still occasionally resorted to, colza often supplies their place. It is sown broad-cast in July, as turnips are. The ground is ploughed in autumn and in spring, and again a short time before the seed is sown, and well manured with farm-yard dung. The seed is sown very thin and harrowed in: as the plants come up they are weeded and thinned out, so as to leave them nine inches or a foot apart. Before winter they have acquired a considerable size, and the stems have had the earth drawn up to them. Thus they remain all winter without injury from the frost: in spring they are weeded again and the earth gathered round each plant, which ensures a vigorous growth of the seed-stem. After flowering in April and May, the seed-pods fill, and begin to get ripe in June or July: care is taken to cut the crop before the pods are fully ripe, or they would shed a great part of the seed. Dry, warm weather suits this best; as then the stems may be laid on the ground for a short time to dry, and the seed may be immediately thrashed out on a cloth in the field, which is soon accomplished if the weather permits. The crop is then safe, and is stored in a dry and airy granary till it is sent to be crushed.

But this is not the mode in which colza is cultivated in the other parts of Flanders, as there fallows are unknown, and the land is never left idle. The seed is sown in a bed of good earth, prepared on purpose to raise plants to set out after harvest, when the land has already yielded a profitable crop. These plants are taken up carefully in October. When the stubble has been cleared of weeds by the harrows, the land is well manured, ploughed to a good depth, and laid in stitches: the plants are then brought in baskets to the field. A man, with a wide spade made on purpose, opens a gap in the soil, by planting in the spade vertically, as far as the blade will go, and then pressing the handle towards his body; a woman or child with a basket or bundle of plants immediately sets one in each corner, and the spade handle being replaced in a perpendicular position, the earth falls back upon the two plants. The man when he has drawn out the spade,

puts his foot between the two plants, and thus presses the earth against their roots. The whole of this operation is performed in far less time than we have taken to describe it: in fact, practice gives such dexterity, that a double row of plants is set in a very short time all along the bed: the next double row, which is set in returning, is eighteen inches distant from the first, and the plants are placed so as to alternate with those in the first row. Instead of a spade, some use an instrument called a *plantoir*, which makes two holes at once, and is pushed in with the foot pressing on the cross bar C D, (see fig.) while the handle A B, is held in both hands. In



this case a plant is set in each hole by a person following the dibbler, and the earth is pressed to it by the foot. Whichever way the plants are put in, some will always fail, and a supply is kept in the seed bed to replace them at any time in autumn or spring. The intervals between the rows are hoed and weeded, and even sometimes dug with the spade, which is a good practice; and the plants are treated as cabbages are in a garden. In November, before the frost sets in, the intervals between the stitches are dug out, and the earth placed in small heaps between the plants, both to receive the mellowing influence of the frost, and to protect them against very cold winds, which, when there is no snow, sometimes injure the young colza. In spring these heaps are levelled, and the earth is raised around the stems. They cannot fail to grow and shoot out strong seed stems and succulent leaves. These leaves are much relished by cattle, and this sometimes induces the small farmer to gather a portion of them for his cows, at a time when fodder is scarce; but he pays dear for this supply, by the diminution of the seed, which is abundant in proportion to the luxuriance of the leaves on the stem at the time of flowering.

When the colza is cut, it is thrashed, as described before, unless the weather be very unfavourable, in that case it is dried, as well as circumstances permit, without much handling: it is then laid in layers with dry strsw, and stacked in the field, or carried to the barn. This plan is however seldom resorted to in Flanders: the season in general permitting its being housed in a dry state, if not threshed in the field.

To save time and trouble the plants of colza are sometimes put in with

the plough, being set in the furrows, as we have described in planting potatoes; with this difference, that the plants are set upright, or rather slanting a little against the furrow-slice last turned up, and the return of the plough covers the roots, leaving the crown above ground. A man goes along the furrow, and with his foot presses against each plant to settle the earth around it. This method is not so much practised in Flanders as it is in other parts of Belgium, where the extent of farms is much greater, and where so much labour cannot well be spared for each crop. It is a less perfect method, and the plants do not take root so certainly, or grow so well as by the other.

An acre of good colza produces on an average thirty bushels of seed. In March, after the colza has been hoed, carrot-seed is often sown in the intervals: it comes up well, and after the colza is reaped, and the ground has been cleared of the stumps which remain, the carrots are thinned out, and get to a good size before winter.

The colza is sometimes sown thick and broad-cast, to serve as food for cattle and sheep in winter and spring, but the *Navette* (*Brassica Napus*) is more usually sown for this purpose.

The *Navette*, which is also called *Rabiolle*, is a plant of the cabbage tribe, which grows well in lighter soils than suit the colza. If it were not for this peculiarity, the colza, as more productive of seed, would always be preferred. The navette is not usually planted out, but sown broad-cast and thinned out. If it is sown in spring, it will run to seed in autumn, but its produce will be less: if it be sown in autumn, it will stand the winter, and seed early in the next summer. This is the preferable method, as it may be sown after harvest, and when it is ripe there is good time for a crop of turnips after it. As a green crop it is excellent for sheep, and may be advantageously sown, to produce early food for them in spring. It is, however, not so much cultivated in Flanders as the colza. The seed produces an oil of similar quality.

The poppy is cultivated in Flanders for its seed, from which an excellent oil is expressed, little inferior to that of olives. There is a white variety of the poppy and a purple: the first produces the best oil, the latter the greatest quantity. A rich loamy soil is the best for this plant, as it is for most others which bear oily seeds: and it is prepared in the same manner as for any other spring crop which requires a rich deep soil. Two ounces of seed is an ample allowance for an acre of land, which is ploughed in stitches, and harrowed before the seed is sown: the earth out of the intervals being thrown over the seed, the harrows reversed are drawn over it. In May the plants are thinned to a foot distance each way; for each throws out many stems. In August the seed is ripe, and it is gathered in a manner which will appear tedious, but which is effectual to obtain all the seed in perfection. When some of the heads begin to dry, and the openings through which the seed sheds appear under the crown, men and women go along the rows of poppies, and shake every head in succession over a basket or box hung on the left arm, without breaking the stems: all the ripe seeds which are loose in the head, drop out, and in time the basket is filled, and the seed is put together in sacks. A few days after the same operation is repeated, after which the stalks are pulled up and tied in bundles, which are placed upright in the field, that the remaining seeds may ripen: they are then finally shaken out, and the whole produce added together may amount to twenty bushels per acre. The heads and stalks are of little use, and are either burnt on the ground for the sake of the ashes, or are carried home to help to heat the copper in which the food is boiled for the cows, as we shall see hereafter. When

the poppy-heads are wanted for the druggists, they are cut off, with a portion of the stalk, before the seed is ripe, and when there are no apertures under the crown. They are tied together, and hung in a shady and dry place to lose their moisture. In this state they contain the soporific juice, for which they are used in fomentations, &c. The cultivation of the poppy for this purpose is chiefly in gardens.

There is another plant occasionally cultivated for its oily seeds, which is the *cameline.*—(*Myagrum Sativum*)—a plant frequently found in the fields, and eradicated as a weed. It has the peculiar advantage of ripening its seeds in the short space of three months from the time of sowing. It is on this account sown in spring, when the colza, rape, or any other crop has perished in winter, which sometimes happens, when there are frequent alternations of frost and thaw during that season. The ground being ploughed and barrowed, a small quantity of the seed, less than 2 lbs. per acre, is sown mixed with fine sand or ashes to distribute it more equally. The bush-harrow or traineau sufficiently covers it; and as it will grow on very poor land, no more manure is required than was left by the last crop. If it is sown in May, the seed will be ripe in September, and is then treated exactly as the colza or the navette. The produce in rich soils is less than that of either of these last: but it may be sown where colza would give no adequate return; in good land it is confessedly only a substitute. With the stems of the cameline useful brooms are made, and in some places the plant is cultivated for that purpose: it forms a part of the industry of the small farmers, who have but a few acres of land which they cultivate with the spade, as in the neighbourhood of Alost and the Waes district. It is well worthy of trial in soils and situations where the usual plants cultivated for their oily seeds will not thrive.

Some of the varieties of the *sinapis*, which infest our corn-fields, yield a sufficient quantity of oil to make it a question whether they might not be advantageously cultivated, for this purpose, especially on thin chalky soils. In some parts of the continent, where agriculture is little understood, and the fields are sometimes covered with these plants in full seed at harvest, the poor people readily gather them from among the corn, and have the seed ground and pressed for the oil, which they use in their lamps in winter.

Chapter XI.

OF THE CULTIVATION OF PLANTS USED FOR THEIR COLOUR IN DYEING; AS THE WOAD, WELD, MADDER;—AND OF HOPS AND TOBACCO.

The woad (*Isatis Tinctoria*) has been introduced into Flanders for the sake of the blue dye which is produced from its leaves. But it requires great nicety in the preparation, and has not yet been very extensively cultivated. During the reign of Napoleon every exertion was made to raise within his dominions any produce which had generally been obtained from the East or West Indies, as far as the soil and climate of the countries included in his empire would permit; dye stuffs attracted his particular attention, and the cultivation of the Isatis Tinctoria was greatly encouraged. This plant is called *Pastel* in French: it has a cruciform flower of a yellow colour, and large alternate leaves from which the dye is obtained. Although now mostly superseded by indigo from the colonies,

it is still used to mix with that dye, of which it improves and fixes the colour. It is cultivated in the neighbourhood of Valenciennes in France, and in some few spots in West Flanders; but that which grows in the south of France near Toulouse and Avignon, is considered of superior quality. A good deep loam is the proper soil for this plant, of which there are two varieties: the one which is larger than the other and preferable on that account, has the leaves smooth and the seeds of a violet colour. The land on which it is cultivated is laid out in beds, and very highly manured. The manure used is such only as is well decomposed, and it is thoroughly mixed with the soil. In fact, a good preparation for flax will be equally so for pastel. The seed is sown very thin, in March; the plants requiring much room, dibbling it regularly would be an improvement, taking care not to put it in too deep. In the beginning of May the plants are thinned out, if they are too close. They are left from a foot to eighteen inches asunder at least. In the end of June the leaves begin to be fit for gathering, which is known by their bending down, and turning slightly yellow. A dry time is necessary for this gathering, which is repeated three or four times as the leaves arrive at the proper state of maturity. Considerable attention is required to produce the most perfect colour, as well as the greatest quantity of the dye. If any dust or earth adhere to the leaves, they should be slightly washed, and set to dry in the sun. They are the better for a slight drying before they are carried to the mill. They should never be heaped up in the fresh state so as to excite the least fermentation. They are ground into a paste in a mill constructed like an oil-mill. The paste is well pressed with the hands and feet under a shed, and made into one or more heaps, of which the surface is made smooth. There it heats, and a hard crust is formed on the surface, which must not be broken on any account; all cracks in it are immediately stopped with some of the paste. In a fortnight the fermentation is completed, which is known by the cessation of the strong ammoniacal smell, diffused during the time of its continuance. The mass is then broken up, and the crust is well mixed up with the interior parts. The whole is formed by the hands into balls of about 1 lb. weight each, and then pressed into oblong moulds, and formed into cakes like small bricks. These being carefully dried are fit for sale. Whether the cultivation of woad is profitable or not depends so much on the price of indigo, and the demands of the manufacturers, that the cultivation of it to any extent must always be attended with some risk. A small quantity however, proportioned to the wants of the dyers around, may always be raised with advantage.

The Weld, (*Reseda luteola*) is also a plant raised for the yellow dye which it affords. Its French name is *Gaude*. It is an annual plant which grows three or four feet high: its flowers are greenish, growing in long spikes. It is a native of Europe, and found along ditches, roads and woods. It is consequently hardy, which is not the case with the small species called mignionette, so commonly sown for its sweet smell. The weld will grow in most soils, and does not dislike those which are slightly wet, but it is most productive in good soils. It may be sown after rye, potatoes, or turnips, about once in eight or ten years, and without any manure. In southern climates, it is sown in autumn, but in the northern, always in spring. The seed being small is usually mixed with sand or ashes when sown, and covered only by the bush-harrow or traineau. When the plants begin to cover the ground, they are carefully weeded or hoed, and no further care is necessary till the end of summer, when the seed is ripe, and the stem begins to put on a yellow tint. The plants are then carefully pulled up, and immediately taken to a place where they can be sheltered in case of

rain; they are set up against walls or hedges exposed to the sun, that they may dry rapidly; when sufficiently dried the seed is beaten off with sticks, or against a board set on edge, and is caught on a cloth. Bundles or sheaves are then made of the dried plants, and deposited in a dry and airy place under cover; they are sold in that state. A simple decoction of the plant is used in dyeing.

Madder has been long cultivated to a great extent in the rich alluvial soils of the province of Zealand, which forms a part of the kingdom of Holland; but it has also been introduced into the Flemish polders, and an establishment for its cultivation and manufacture has also been formed, under the protection of the Belgian government, by Mr. Van der Plancke, at Drongen near Ghent. The account of the cultivation of it which we shall here describe, is partly taken from the 'Dictionnaire d'Agriculture,' Paris, 1820; and partly from a pamphlet published by Mr. Van der Plancke, Ghent, 1830. The madder is called in French *Garance;* in Flemish, *Meekrap.* It is the *Rubia Tinctorum Sativa* of Linnæus. It comes originally from the southern parts of Europe, or the north of Asia; but it has been long domesticated in the north of Europe, and improved by assiduous cultivation. It has a long herbaceous stem, and roots which, in good ground, extend several feet in length. The outer skin of the root is yellow, the internal part red. It is this root which is the object of cultivation: a rich light soil of great depth is essential to its success. This immediately indicates that trenching with the spade two or three feet deep is a necessary preliminary. The ground should have a supply of humus diffused through the whole mass of the soil, which can only be obtained by a course of high cultivation for a considerable period, and particularly by that of artificial grasses. If there were rich dry old pastures which could advantageously be broken up, which are not often found in Flanders, these would give the best soil for the roots. But then a deep trenching is still required, and repeated ploughings, to render the soil loose and friable. The preparation of the land begins in the autumn, in the manner which we have repeatedly described when a very good tilth is required for the ensuing spring-sowing or planting. The dung is ploughed in before winter; the *vidanges* or urine poured on in spring.

Madder is usually sown in a seed bed, and transplanted where it is to remain. The seed is sown while yet fresh; for when it is kept till very dry and hard, it is a long time in coming up, often as much as a year or two. It is therefore kept moist in sand, until it is wanted to be sown. A rich bed is made in a garden or field in spring, and the seed is deposited in small drills. The ground is kept watered in dry weather; if the plants come up well, they are transplanted when a twelve-month old. The ground on which the plants are set is divided into narrow beds about three feet wide, and two rows of plants are set about a foot apart upon each. Great care is taken both in raising the plants from the seed bed, and in planting them out, not to injure the roots. They are taken out of the earth, only in such quantities as may be set immediately, that the roots may not be too long exposed to the air. The instrument for setting them is a narrow-pointed hoe, very like that which is known by the name of the Vernon hoe, so useful in hoeing wheat, but with a short handle. A hole about six inches deep is made with this instrument a foot from the left side of the bed, and the plant is immediately inserted in it; the earth is then pressed round it, and another plant is put in similarly at a foot distance to the right of it. The labourer then retreats a foot back, and sets two more; and so on till the whole bed is planted with two rows of plants. Four rows are sometimes planted in a bed five

feet wide: a line is then stretched along the middle of the bed, and two men, one on each side of the line, plant two sets each, one man with the right hand, and the other with the left, one foot being in the interval, and the other on the bed to press the earth to the plants; by changing sides the fatigue of the position is lessened. In this way it is thought that the finest roots are produced. But there is a readier way, which is to plant the young shoots which rise from the crown of the old plants, and which are carefully taken off with some portion of the root: these shoots are planted as we have described before. It must, however, be observed, that if this last method be long continued in succession, the plants degenerate, and are much inferior to those produced from seed.

The after-cultivation of the Madder consists in digging between the beds and hoeing between the plants. The first operation may be performed with the plough, when the extent is considerable, the other with a horse-hoe. Before this is done, however, it is very useful to pour a considerable quantity of liquid manure in the intervals between the beds. These intervals are dug out and stirred, until the roots of the madder reach them, which they will by the second year, and then the surface only is hoed and kept free from weeds; the earth dug out at first is thrown on the beds around the plants.

The green stems and leaves of the madder are often cut down once or twice in the second year, and given to cattle; but although this may be allowed to a small extent, cutting off some of the redundant stems, it injures the root if done too often. Cattle are very fond of this food; but if they eat any of the roots, their bones will in time be tinged of a red colour: so penetrating is the colouring matter in it, that even the leaves are said to do this in a slight degree. In very dry climates the mode of planting is reversed, that is, the plants are set in the hollows between the beds or ridges, that they may have more moisture, and they are earthed up from the higher parts; but in the moist climate of Flanders or of Britain excess of moisture is more to be feared than the want of it. In the third year the roots are taken up. In order to do this without breaking them, the intervals of the beds are carefully dug to the depth of two feet, and then the roots are readily disengaged from the earth in which they grew by means of forks and small pick-axes. The expense of this labour is amply repaid by the greater quantity, and better quality of the produce. The plough might be used, if it could be made to go eighteen inches deep so as to reach under the roots, but in this case a plough must be constructed for the purpose. Such a plough is noticed in the 'Dictionnaire d'Agriculture,' as being used in England drawn by twelve horses: we confess we have never seen it: but the newly-invented subsoil plough might be used for this purpose.

When the roots are taken up they are left on the ground to dry partially, so as to become tough, and not break so readily; after which they are put in heaps, and left for three or four days, covered with straw if the weather be rainy. The sooner they are housed after this the better. Every care should be taken not to break the roots. The next operation is to dry them slowly in a kiln, and then they are in a fit state to be sold to the dyers, or to those who prepare the dye.

Hops, of which the cultivation is so well understood in England, are also extensively cultivated in Flanders. But there are no hop-grounds there of any such extent as those of Kent or Surrey. The hops are chiefly cultivated by small proprietors or farmers near Alost, Ypres, and Poperingen; a sheltered spot with a good soil, where the loam is rather stiff, is preferred. Half an acre of hops is a common quantity for one

farmer. The preparation of the ground is, again, such as we have so often described for deep-rooted plants. The field having been prepared, and levelled with the harrows, is divided into squares by parallel lines drawn at the distance of five or six feet, and similar lines at right angles to them. At every intersection of the lines four plants of hops are set, in the month of April, one in each angle, four or five inches from the point of intersection, and four inches in the ground. A few days after, the earth is dug out around these sets, so as to form a small circular trench, in which some well rotten dung is deposited and covered with the earth first taken out. As soon as the plants begin to grow, a pole ten feet long is stuck in each intersection of the lines, or sometimes two poles are placed slanting towards each other, to enable them to resist strong winds. The bines as they grow are led towards the poles and tied to them with rushes, until they are strong enough to take hold of them. If there are more than four, the surplus is pinched off. The first year there is but a small produce of hops; but the intervals between the hop plants are planted with cabbages or beans, or sown with turnips.

In the second year the earth is raised around the plants, and the ground is kept clean with the hoe. Taller poles, fifteen to twenty, and even thirty feet high, are now placed where the former were, and the mounds of earth round the plants are watered with liquid manure, which soon sinks in. When oil cakes are dissolved in the urine, the effect on the crop is soon perceived by the vigour of the growth. In August the hops are in bloom, and then the earth is again hoed and loosened round the plants. In September, when the flower closes, and a yellow powder appears on it, they are fit to be pulled; the poles are taken down, and the bines are cut about four feet from the ground. The hops are then gathered, and, if possible, dried in the stove the same evening.

In October or November the soil is stirred, and all the remains of the bines are cut down two inches above the root. The earth is dug out all around, and a hillock two feet high is raised over the plants; and so it remains till next spring. In April the earth is removed, and all the tops of the shoots which have grown out in the loose earth are cut off, and when dressed like asparagus are very highly prized by gourmands in Paris. The main shoot is also cut down four or five inches above the ground, and the earth moulded up around it. A hop-garden well cultivated will be productive many years. An acre of hops produces nearly 1600 lbs. of dried hops, which is a large crop, and must be ascribed in a great measure to the liquid manure. The price varies as it does here. If it is less than half a franc a lb. (five-pence) it does not repay the grower.

Tobacco is raised in almost every farm, to a small extent, for home consumption, there being no government monopoly of this drug in Flanders. In East Flanders near Grammont, and in West Flanders near Menin, and along the Lys, the cultivation of tobacco is more extensive. It grows well in light soils, but in the good loams its quality is better. The ground must be well stirred, and amply manured, especially with as much rape-cake, as can be procured, dissolved in water or urine: 2000 cakes per acre are not thought a great dressing, double that quantity is better. Care must be taken not to use horse dung, and still less the urine of horses; it is too hot and strong, and gives the tobacco a bad flavour. The tobacco seed is sown in March, in a seed bed will prepared, in a sheltered situation. In case of frost the beds are protected by litter or fern, as the young plants are very tender; they are then weeded and thinned out to give them strength.

The ground having been well tilled and manured, and being harrowed

flat, the tobacco plants are set up to the first leaves in holes made by a blunt dibble, and the earth is pressed round them. They are placed in regular rows two feet wide, and fourteen inches from plant to plant in the rows. In a fortnight the intervals are well hoed to a good depth, and each plant has a slight manuring with rape cake dissolved in water. When the tobacco plants are a foot high, the intervals are hoed again, and the earth is drawn up around the stems; when ten or twelve leaves are come out, and the crown or bud is perceptible, it is pinched off with the fingers, which is done to check the growth of the stem upwards. Every lateral shoot is likewise removed as soon as it appears. When the leaves begin to grow yellow, it is time to pull them. This is done close to the stem, or the whole plant is cut down at once on a dry day. They are left on the ground for a short time, but are housed soon after sunset. The leaves are strung on packthreads, and hung up in an airy building made on purpose, not unlike the buildings at the paper-mills, where the paper is dried.

As soon as the leaves are dry they are tied by the stalks, in bundles of fifty or sixty leaves: these are hung up in the house, or placed on the floor, and frequently turned, to prevent heating. As soon as the weather is cold, they are stacked in heaps: these are frequently examined, and if any heat appears, they are taken down, and made up again. As soon as all danger of heating is over, a cloth is put over the heap, and it is pressed down with weights, which tends to improve the quality.

An acre, well cultivated, will produce from 3000 to 4000 lbs. of tobacco. But it is a very precarious crop, and the outlay is very great. The ground, however, is enriched, and will produce very fine crops after it. A few of the plants are left for seed: of these the buds are not pinched off. The seed is ripe in September.

Chapter XII.

OF THE MANAGEMENT OF GRASS-LAND.

Along the principal rivers of Flanders, there are good natural meadows, which, being flooded once a year in the latter part of winter, and thus recruited by a deposition of mud from the water, produce excellent herbage, which is made into hay every year, without fear of exhausting the soil. Others are situated lower, and are more apt to be inundated at times when the herbage, having already acquired a certain growth, is injured by water. Those which are entirely above the highest level of the waters, are considered as inferior in value, and if they are not converted into arable fields, it is because they are of a cold and wet nature, and this kind of soil is peculiarly disliked by the Flemish farmer. They form what are called *sour* meadows, and the proper mode of improving them is pointed out in a memoir written by Mr. Van Aelbroek, which gained the medal offered by the Brussels Agricultural Society, in 1825. It consists in draining, as the fundamental corrective of stagnant water, destroying the coarse sward by two or three crops of corn, enriching by manure and lime, and laying down to grass with choice seeds. In this way a wet, sour meadow is converted into a rich, fine pasture.

These meadows along the rivers are not generally occupied by the farmers of the adjoining lands; but the crop is annually sold by auction,

when it is fit to cut. The price thus obtained is much above the rent which the land would let for on a term, but the consequence is that the meadows are not sufficiently attended to, and are allowed to be overrun with weeds and coarse grass; and those which are not flooded annually are gradually exhausted, so as to require manuring with dung or ashes to restore their fertility.

The price of an acre of good grass is from 2*l.* 15*s.* to 5*l.*, and the produce from two to two and a half tons of hay. The meadows which are not annually flooded, are sometimes depastured with bullocks for two or three years, which renders the grass much finer, and enriches the soil by the dung and urine of the cattle; the treading also tends to destroy many rank weeds, and to give the roots of the grass a firmness which makes it shoot out vigorously.

When grass land is deteriorated by continued mowing, or when the soil is wet and cold so as to produce rushes and coarse weeds, the best remedy is to plough it up, and cultivate it as arable land for a few years. The manure used in this case is lime and ashes; and if a good system of draining were introduced, a thing little practised in Flanders, many a poor sour meadow might be rendered equally fertile with the best. The usual mode is to plough up the sward in autumn, letting it rot during winter, harrow it well in spring, and sow oats in it. The crop is always abundant, and if after this the land were well manured, and laid down again with good grass seeds in a crop of barley or wheat, the meadow would be renovated without loss of fertility; but several crops are usually taken before it is laid down again, and there is not a sufficient attention paid to the selection of good seeds. The sweepings of hay-lofts are thought good enough for this purpose, and the consequence is, that only some of the earliest grasses, which have ripened their seeds when the hay is made, make their appearance in the new meadow: the grass is poor and thin till the natural grasses have sprung up; and all the weeds of which the seeds were ripe, are reproduced in the new meadow. Some more careful proprietors select a portion of good grass, and allow it to stand till the seed is ripe; it is then mown or reaped by hand, and thrashed on a floor like corn: thus good grass seed is procured, and the result is a speedy renovation of the meadow. When the meadows are below the level of the waters, so as to be subject to inundations at the time when the grass is already grown, and liable to injury by the muddy deposit, the only remedy is to raise the surface by digging numerous ditches all over the land, and throwing the earth on each side. By this means strips of land are raised above the floods, and in time the ditches are filled with the muddy deposit, till at length they are obliterated, and the whole surface being raised so as to be only flooded in winter, a most fertile meadow is produced. In the western part of Flanders, about Ypres, and from that to Dixmude, there is a tract of land which has evidently been an ancient polder, and is now covered with the richest pasture: it will fatten a moderate sized ox per acre in four or five months, and the cows fed upon it give an extremely rich butter. This butter is renowned for ship provision, and is exported in large quantities: much of it comes to England, where it is confounded with the Friesland butter, which is of a similar quality. The natural richness of the pastures is the cause why little attention is paid to improve them, or to prevent their being deteriorated; and some of them gradually become so overrun with coarse grasses and weeds, that where the farmer is not absolutely restricted from breaking up the grass, as is generally the case, he finds it very advantageous to convert them, for a time, into arable land. The produce, at first, is most abundant, and this is so strong a temptation to over-cropping,

that they are seldom laid down again without being much exhausted, and requiring several years to restore a good sward. Although the weeds are eradicated, the land is not improved. This might be obviated by a more judicious system; and considerable profit might be obtained from the conversion of the pasture into arable land, which might be laid down again in a clean and good state, so that the grass which immediately followed the corn should be abundant, and of an excellent quality for hay, and the pasture after the first year, as good as ever. In this particular instance the Flemish farmer might take a lesson with advantage from our countrymen in the north, who so well understand the convertible system of husbandry; particularly in Berwickshire, Roxburghshire, and the Lothians*.

The manner in which the hay is made in Flanders, differs little from that which is common in England. The mowers hold the scythe somewhat differently; the handle is straight and long, and the end passes over the left arm; the stroke is not quite so free, but the grass is cut close and even, and there are not so many inequalities to be seen in the remnant of the grass, as is often the case in our meadows, when the mowers are not closely watched, and wish to get over their work too rapidly. Clover is not much shaken out, and sometimes it is tied up in sheaves with straw bands like corn. It is always tied up in bundles when sufficiently dry, and thus stacked in the barn. Hay-ricks are not common, except in the large farms of the polders; and where small ricks are made they are usually built round a pole, and are more like cocks than ricks, containing at most five or six tons of hay each. In the neighbourhood of Dixmude and Ypres, however, square ricks may be seen of forty or fifty tons, and tolerably well thatched; but none have that neat and trim appearance which the hay-ricks have in Middlesex, of which the sides and ends are pulled, so as to present a smooth surface, and the thatch is laid as neatly as that of a barn.

There are some water meadows along the rivers with proper sluices to regulate the irrigation, but they are not very common, nor laid out with the same art and regularity that our water meadows are in general; small ditches and open drains, to facilitate the running off of the water after a flood, are usually made to assist the simple inundation of the land, and prevent the water from stagnating in any lower spot, where it would injure the grass. The meadows situated above the rise of the rivers are seldom irrigated by diverting a portion of the river in a channel from a higher point, because the fall in the rivers being very small, the length of the canal would be too great to obtain a sufficient fall: where there are falls, they have been taken advantage of to drive water-mills; and there are antient rights which interfere with any deviation of the current.

With the exception of those extensive pastures which we have mentioned in the south-western part of Flanders, there is not much grazing land. Stall-feeding is universally adopted, and the cattle, fed on roots and clover mixed with meal, are only let out occasionally in summer for a few hours in the day to have a little exercise, and keep them in health. In many farms, especially the smaller, to which no pasture is attached, the cattle never go out of the stable, but have even their water brought to them. In this manner the cows certainly give more milk, and the oxen fatten readily, but they are more subject to epidemic diseases, which frequently carry off a great part of the cattle, without any certain remedy having ever been discovered for this evil.

* See account of Select Farms, No. V.; Scoreby, p. 13; Farmer's Series of Library of Useful Knowledge, No. 25; and Blackie on the conversion of arable land into pasture, 1817.

Chapter XIII.

OF CATTLE.

The number of beasts fed on a farm of which the whole is arable land, is surprising to those who are not acquainted with the mode in which the food is prepared for the cattle. A beast for every three acres of land is a common proportion, and in very small occupations where much spade husbandry is used, the proportion is still greater. To give an idea of the system, it is necessary to reflect, that in every farm a fifth, at least, of the land is sown with turnips immediately after harvest. These turnips are not such as are sometimes sown in England under the name of stubble turnips, in the end of August or in September, and give but a poor produce during the winter and early in spring, but they are of a quick growing sort, and are sown in succession from July, after the colza and winter barley are reaped, to August, after the rye, as we have described in the eighth chapter. They are already of a good size in September and October, when they are stored in cellars for winter use. Besides turnips, a considerable quantity of potatoes are raised, more than is required for the use of the family, and these are generally consumed by the cattle. Carrots which have been sown in spring either alone or amongst the barley, flax, or colza, complete the winter's provision. These roots are chopped up together in a tub, and some bean-meal, rye-meal, or buckwheat-meal, is added: boiling water is poured over this and allowed to cool; or the whole is boiled together in a copper, when fuel is not too scarce. Of this mixture, which they call *brassin*, two pails full are given milk-warm, morning and evening, to each cow, and this is their food during the whole winter with a little wheat or barley-straw. Hay is only given in a few districts, where the pastures are extensive, as about Furnes and Dixmude, but never in that unbounded quantity in which the cows eat it in England. Very little hay is made in any other district, and that only clover hay, which is reserved for the horses when they work hard. Near the towns or large villages, where there are brewers, grains are added to the other ingredients of the brassin, and they greatly increase the milk.

The same food is given in greater quantity, and with more meal in it, or sometimes with bruised linseed cake, to fatten cows or oxen. The profit on these, when thus fed, is not considerable, and much under that of the grazier who fats them in rich pastures on grass alone: but the manure produced by their dung and urine is the great object in view: especially where it cannot be procured in sufficient quantities from the towns, owing to the want of water-carriage and the badness of the roads. A moderately sized ox will eat three baskets of turnips daily, which is the average produce of about the one hundred and fiftieth part of an acre: ten beasts will therefore consume the produce of an acre in fifteen days, or of about ten acres in five months: two acres of potatoes and one of carrots will enable the farmer to feed three or four beasts more, by mixing them with the turnips. Some farmers cut all the straw which is given to cattle into chaff, and mix it with the brassin; it is thus supposed to go much farther than when eaten from the crib: but as mastication causes the saliva to flow, and greatly promotes digestion, it seems probable that there is an advantage in allowing the cattle to chew some dry straw.

A great number of cows and oxen are fattened in the distilleries on the refuse wash, and many farmers prefer selling their cows, when they have

had four or five calves, without attempting to fatten them, and rearing young heifers in their place, thus keeping up their stock of milch cows. After comparing the accounts given in a variety of places and situations of the average quantity of milk which a cow gives when fed in the stall, the result is, that it greatly exceeds that of our best dairy farms, and the quantity of butter made from a given quantity of milk is also greater; an ordinary cow fed on young clover will give at three milkings, for the first three months after calving, from fifteen to eighteen quarts per day, which will produce $1\frac{1}{4}$ lb. of butter, that is nearly 9 lbs. of butter per week. Where the number of cows is great, the average is much less, because when there are only two or three cows, a deficiency in one of them is immediately noticed; the cow is got rid of, and a better one purchased. In a great number, there are always a few inferior cows, and a lower average is the consequence. It appears astonishing that the occupier of only ten or twelve acres of light arable land should be able to maintain four or five cows, but the fact is notorious in the Waes country. The cows are the principal object of attention:—the butter which is sold weekly pays the outgoings of the farm: the buttermilk feeds the family and the pigs: the bread is boiled in it for soup: it is eaten with potatoes instead of butter: it is made into hasty pudding with buckwheat flour: it is the meat and drink of all; and as long as the cows give plenty of milk there is no want in the house. A falling-off of the milk is immediately noticed, and the food of the cows is increased, or changed till the usual quantity is obtained. But something is also due to the careful selection of the animals. The best cows come from Holland, especially from Friesland; they are brought over the frontiers in great numbers and sold in calf to the Flemish dealers. The principal market for them is Malines. Good-sized cows sell for as much as they usually do in our country fairs, that is from 8*l.* to 12*l.* each with a calf, or when just about to calve, which is generally in May. If the calf is a female she is reared; a bull-calf is sold immediately, or fatted for the butcher. There are too few fine bulls kept amongst the small farmers in Flanders to keep up a good breed. There is also a predilection for large heavy animals, from the idea that a large beast is more profitable when fat than a small one; a notion which our Essex and Norfolk farmers who fat the small Scotch oxen, will not readily allow. When a bull-calf is reared, the largest and strongest in the limbs is usually preferred, even with inferior symmetry, and the produce is coarse, as may be naturally expected. Some very good bulls have been introduced of late years from various countries, and a fine young short-horn bull brought from England is now, or was lately, in the possession of Count d'Hane, at Lovendighem near Ghent, which will at least serve as a specimen of an improved form. The same gentleman has procured cows from Switzerland and Holstein, the latter a very fine short-horned breed: and under the fostering care of the Belgian government, which pays great attention to every thing by which the prosperity of agriculture can be promoted, a taste for improved forms in the domestic animals cannot fail to be produced. The establishment of a veterinary and agricultural college at Brussels on an extended scale, will soon diffuse around true notions with respect to the breeding of cattle, whether milch cows, or oxen for the butchers, two things which are quite distinct, and in some measure incompatible. In the mean time the Dutch cows are the best and eagerly sought after. The oxen preferred for feeding, are those which have been worked in the Campine: in Brabant and Namur they are still sometimes used for the plough instead of horses. At the distilleries they take all sorts of cows, often without sufficient discrimination, and on the rich wash they all get flesh in some reasonable

time; but few experiments are made to show what breeds fatten at the least expense, or give the greatest profit. If this were done frequently, there would remain no doubt as to the form which fattens most readily.

The cattle are kept on brassin and cut straw till May, when they are turned into the pastures, if there are any. But in all the upland farms where the land is mostly arable, the food is cut for them and carried into the stalls. This consists of winter barley, or vetches, and clover, chiefly the latter. At first, when the clover is very young, it is given sparingly, and if all the turnips are consumed, boiled potatoes with a little hay are considered as a useful corrective; for clover, given injudiciously, causes the cows to heave *. By the time the clover is in bloom it is their only food. Clover is not supposed to give the milk or butter any bad taste, as many think in England; although nothing gives so fine and rich a flavour as natural meadows. The butter made when the cows eat clover does not keep so well when salted; but there is so great a demand for it in the numerous towns and villages, that there never is any difficulty in disposing of it in a fresh state, that is, moderately salted; for as soon as the butter is made a considerable portion of salt is always added.

In the large dairies about Furnes and Dixmude, the milk is set in shallow pans on a cool brick floor in the dairy house, and skimmed, as is the case in England: the cream alone is churned three times a week. A barrel churn is commonly used which will churn 40 or 50 lbs. at a time. It is sometimes turned by hand, but as this is rather hard work, a horse mill is frequently erected to turn it. The butter, as soon as it is taken out of the churn, is well washed and worked with a cool hand, or a kind of spatula or flat spoon, till all the milk is washed out. It is immediately salted and put into casks which contain about $1\frac{1}{2}$ cwt. If the quantity made at once is not sufficient to fill the cask, it is pressed down, and the surface laid smooth; some salt is dissolved in water, till it is nearly saturated, and this is poured on the butter, so as to cover it an inch deep: a linen cloth is then inserted, and laid smoothly over the butter, to exclude all air; and this is kept down by a round board with a weight upon it: when more butter is added the cloth is removed, the brine poured off, and the new portion added is pressed close to the other. Thus no streak is observable in the place where the different churnings join. The butter made in summer, when the cows feed in the rich pastures, is of a fine golden colour, and to those who do not dislike a little saltness, it is much better when a week or a fortnight old, than when fresh churned, and not salted. It keeps perfectly well for a twelvemonth or more. The casks are made of clean white wood and are prepared by well scouring with brine and rubbing the inside with salt. It is of consequence that they be well made and air tight. Dixmude is the great market for this butter, which is exported in considerable quantities: much of it goes to Ostend, where it is shipped, and a considerable portion, as we observed before, comes to England as Dutch butter.

* Mr. Van Aelbroek gives a curious remedy for cattle which are hoven by eating young clover too greedily. It is as follows:—An ounce of horsehair is held over the fire with the tongs, and singed till it forms a crisp round ball, which when cold is well covered with butter, so that it may easily be passed into the gullet of the hoven beast. There it sticks, and causes such an irritation, that in a few minutes the animal vomits, and this continues till the stomach is emptied of its contents, and the cow is saved: we have never tried it, but give it on the above respectable authority: should it be efficacious, it is a most simple and valuable remedy, which is always at hand. It is at all events worth trying, where the more certain remedy, by inserting a leathern tube into the stomach, is not at hand. But no farmer who has cattle should ever be without this useful instrument, and we would strongly recommend it to the notice of those who have never used it.

In most of the smaller farms the whole milk, after having stood twelve hours in shallow pans, is poured into a deep vat, where it is left to get slightly acid, it is then churned, in a large upright churn, and treated exactly as described above. It is allowed that the butter churned from the cream is preferable; but the use of buttermilk is so general, and it is thought so much more wholesome than skimmed milk, that the old method is preferred, in spite of the greater labour required to churn the whole milk. The churning is generally done by a horse, where the number of cows exceeds four or five; sometimes, as in Holland, a dog walks in a wheel, which turns the machinery by which the plunger is moved np and down.

There is little or no cheese made in Flanders, except some skimmed-milk cheese for family use, in those districts where the cream alone is churned. The cheese consumed is chiefly of Dutch manufacture.

In the fattening of cattle the same food is used as is given to the milch cows, with the addition of bean-meal, rye-meal, or oats. An ox kept stalled up for six or eight months and well fed, will double his original weight, and pay well for the food he has consumed: but the principal advantage to the farmer is the increase of the liquid manure in his cistern, and of dung in his yard. Each ox is reckoned to produce as much of both kinds together as will manure two acres of land. When a cow appears to increase in flesh at the expense of her milk, it is a common practice to feed her well, milking her as long as she gives a tolerable quantity; and not allowing her to take the bull. Her milk gradually dries up, and by that time she is so forward in flesh as to be soon fit to be killed: the improvement in her flesh fully compensates for the loss of her milk. There are some farmers who purchase young cows in full milk, keeping ten or twelve of them whom they treat as mentioned above, and as soon as one is fat she is replaced by another. If they have skill to select the breeds which fatten most readily, they make a good profit by the milk and the sale of the cow when fat. Abundant food is indispensable for this purpose: the white sugar-beet and the mangel-wurzel are found very good in this case: for milch cows, however, they are thought too fattening.

Very large cows and oxen are fatted in the neighbourhood of Ghent. They are kept stalled longer than usual, sometimes twelve or fourteen months, and are then very fat, especially those which are fed in the distilleries.

The fatting of calves is not so generally attended to in Belgium as in some parts of England; but the method is worthy of notice. In the cow-house, there are several narrow boxes parallel to the wall, about two feet wide, six or seven feet long, and three feet high: the door is in the end. Sometimes there is a door at both ends, which is most convenient to clean out the box. In this a calf is placed, so that he can get up and lie down, but he cannot turn round to lick himself. He is fed three times a-day with new milk, and where they are curious in veal as near Ghent, white wheaten bread is boiled in milk, with two or three eggs beat up in it: and this mess is given milk-warm to the calf at noon: salt and chalk are also given in small quantities. The veal thus produced is extremely tender and white; and in seven or eight weeks a calf is as fat as is required. A greater price is paid for this veal; and the farmer's wife who pays due attention to her calves, finds the additional trouble and expense well repaid. Yearling calves are often fatted and killed, but the meat is neither veal nor beef; and it would probably be found more profitable to keep them another year, in good store order, and then fatten them off. It is generally those who show an early dispo-

sition to increase in flesh that are fatted so early, but for the same reason they would pay much better for the food they consume, if they were kept till they were two years old, and then fatted off. A somewhat similar practice formerly existed in Norfolk; cows were turned out to grass with their calves: between the milk which the calf sucked and the grass, he grew fat as well as the cow, and they were sold off together. The flesh of these calves was called *beefin*, but the practice is now much less common than it was when more of the country remained in pasture.

When calves are intended to be reared to keep up the stock of cows, they are treated, for a week or a fortnight, in the same way as if they were to be fatted. The milk is then gradually diminished and water mixed with it; pulverized oil-cake is sometimes given, and the calves are not placed in narrow boxes, as when they are fatting, but have more liberty; and as soon as they are strong enough, they are allowed to run about in a small inclosure or orchard, which tends to develop their limbs and keep them in good health. They soon begin to pick clover; and when they are about three or four months old, they are fed on the brassin and whatever the cows eat.

The young bulls not intended to be kept as such, are castrated at twelve months old, and the heifers go to the bull at eighteen months or two years. It is customary for a farmer who has sheep, to keep a bull for the use of the parish, in return for which he has the liberty of pasturing his sheep on the stubbles and uncultivated spots over the whole parish.

In consequence of the subdivision of the land, and the small extent of the farms in Flanders, no considerable number of sheep can be kept by any individual: the great advantage of folding on light soils is therefore much limited. There are flocks which consist of the sheep of several occupiers in a parish, and which are led about the sides of roads and lanes to pick up a scanty herbage, under the care of a common shepherd, whose dogs are so well trained, that the sheep feed along the sides of corn-fields and even clover, without being permitted to trespass upon them, although there is no fence of any kind to keep them off. When sheep are fed on the remnants of the clover which has been cut two or three times, lines are sometimes drawn with a plough to divide a field into portions to be fed off successively. The dogs keep moving along these lines, and not a sheep dares pass over them. Thus all the advantage of hurdling is obtained at a cheap rate, and the land is manured equally and regularly. A small fold may occasionally be seen in which the sheep are shut up very closely packed during the nights in summer; but in general they are brought into the stable allotted to them in the farm-yard, and remain there till the dew is off the ground. They have straw for litter and green clover for food in summer: in winter they have straw, hay, and some turnips; but these last are mostly reserved for the cows. The sheep when of a proper age are mostly fatted on corn, and in a very few instances ewes also are kept on extra food for the sake of their lambs, which are fatted for the butcher. Lamb is very seldom eaten, except as a great luxury, and is only found at the tables of the nobility and the resident English: we only met with one farmer who kept ewes for this purpose, but he finds it very profitable, being nearly the only person to whom the butchers can apply for a fat lamb early in the season. We shall have occasion to give some further details of this farm.

The indigenous breed of sheep is large and coarse, without horns and with long falling ears. The wool is not long nor of a fine quality, and in nothing is there more room for improvement than in the breed of this useful animal. There is a very small breed from the Ardennes,

which is like our forest sheep; the flesh is very well flavoured, and the wool is finer than that of the common breed, but in very small quantity; but this breed is not well suited to the mode of feeding in common practice, and the farmers like to have a large carcase to sell, which bring in more money. Some fine Leicester and Cotswold sheep, and some South Downs, have been imported by the government and dispersed through the country, but they are mostly confined to the farms of gentlemen, who keep them more as a curiosity than for profit. The Cotswold crossed with the Leicester is a large sheep with a long heavy fleece, and is likely to do well in Belgium. A ram of this breed, which was sent over to Belgium in 1834, gave a fleece the next year which weighed upwards of 20 lbs. The wool was sorted and combed, at Tournay, and 9lbs. of very fine long wool was the result, besides some good common wool. It was exhibited in the Museum at Brussels in 1835 as a great curiosity. The breed is in the hands of an individual who is likely to keep it pure, and has ample means of raising a good flock. In Flanders it would be almost impossible, with the present system of agriculture, to introduce our sheep-farming system; but in other parts of Belgium, where the farms are larger, there is no doubt but the raising turnips to be fed off by sheep folded on them, would be highly advantageous to the land, and that a good profit might be made by the improvement of the wool and carcase.

Many hogs are fatted in Flanders, pork being the chief animal food of the labourers, every farmer rears pigs, and has three or four hogs in the stye, which are fed with meal, potatoes, and buttermilk, and in time acquire a good size. But the common breed is by no means good, nor is the mode in which they are reared and fed, while in store order, to be commended. They are very long pigs with hanging ears, long legs, thin flat bodies, and falling rumps; the very reverse in every point of what is thought a well-shaped pig in England. The flesh is not ill flavoured, but there is very little fat on the ribs, and the bone is large out of all proportion. It takes six months to fatten a hog of fifteen score, put up to fatten at eighteen months, old, and at the end of that time we should only call him half fat in England, the fat on the chine not exceeding three or four inches, and on the sides scarcely two. The cause of this is the defect in the breed, and also the poor starved state in which the pigs are kept when young, having little to eat but what they can pick up in running about the yards, and the weeds which are pulled up in weeding, which for want of better food they devour. If clover or a few potatoes are given to them now and then, it is as a treat. The expense of fatting these pigs is proved to demonstration by the price of pork in Flanders, which is higher than mutton or beef. If pigs were fattened with less food, this price would be an inducement to the small farmers to fatten them for sale, which is not usually the case. The pig markets are supplied by the millers and distillers, who fatten them on the offal of their trade, more than by the farmers.

The government, aware of the superiority of the breeds common in England, have imported a number of pigs of chosen breeds from this country, and they are spreading fast through Belgium. The superior form and aptitude to fatten of the Berkshire and Essex pigs, and crosses of these with the fine skinned Neapolitan and the prolific Chinese breeds, begin to overcome the prejudices of those who persisted in preferring the old breed; and it will not be very long before the whole race of that extremely useful animal will be completely changed and improved throughout Belgium. At the same time the farmers will learn the advantage of keeping their store pigs in good condition when they are young, advancing the period

when they may profitably put up to fatten, and accelerating the growth of muscular flesh without much increase of bone.

The hogs when fattening are generally shut up in a dark stye and fed in stone troughs. The best mode is to shut each hog in a small stye by himself and let him eat and sleep without being disturbed. The dung of hogs is thought inferior to that of cows as manure, and therefore the pigs are not allowed so much litter as is proper; but this is an error, as is well known to those who fatten many hogs, and who can compare the effect of pig's dung when properly mixed with straw and allowed to ferment in a heap, with that of an equal quantity of cow-dung treated in the same way. The gardens of poor cottagers in England have seldom any other manure than that of their pigs, and the luxuriance of their cabbages and potatoes shows the strength of the manure.

The pork is generally salted in tubs, and kept in the brine, the chines and hams only being hung up to dry or smoked; dry bacon is seldom if ever met with. The common hogs are too thin in the sides to make good flitches, and if the spare-ribs were taken out, there would not remain sufficient substance left to make good bacon.

Chapter XIV.

OF THE BREED AND MANAGEMENT OF FARM-HORSES.

The horses of Flanders have been long noted for their bulk. Flanders mares were at one time in request for the heavy town carriages of the nobility and men of fortune in England and on the Continent. Since the improvement in the roads, and in the paving of streets, activity has been preferred to strength, and the English carriage horses now partake more of the breed of hunters, and are more nearly allied to full blood. The Flanders horses are probably the same at this time as they were a century ago; but compared with the present breeds of coach and cart horses in England, they are inferior. They are in general large in the carcase and pretty clean in the leg, patient and enduring, if not too much hurried. They are steady in the collar, and good at a dead pull, in consequence of their weight: but they are very heavy in the forehand, inclined to get fat, and deficient in activity. They fall off in the rump, and the hips stand out too much from the ribs. The worst point in most of them is the setting on of the tail, which is low and pointing downwards. These are the general characters of the real Flemish horse. A more useful kind of horse, although not so sleek, is found in the provinces of Brabant and Namur, where they draw heavy loads of stones and coal over bad roads. The feet of the Flemish horses are generally flat, denoting the moist pastures in which they are fed when young, or the dung of the stables in which they have stood; for many of them have never been turned out loose, and have been reared and fed in the stable as the cows are. This will account for want of vigour and muscle as well as for the propensity to get fat. The food of the farmers' horses is not calculated to produce hard flesh: green clover in summer, and roots with cut straw in winter, are the chief provender. A few

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oats are occasionally given, and some clover-hay, but not in so regular a manner as to give great muscular strength. From the badness of the roads there is little to do for the farmers' horses in winter. They are often kept idle in the stables, and according to the maxim, that he who does not work should not eat, their allowance is much diminished at that time. They have consequently but little vigour, when the spring brings with it a continued demand for exertion in man and horse; washy food fills the cellular substance, and the skin is sleek; but there is no great power in the muscles. They look like the cart-horses which our dealers *make up* for sale, by giving them boiled grain and other nutritious food. When they are put to hard work they sweat and pant from an excess of loose fat, and consequent deficiency in wind. When the season comes for ploughing and sowing, in spring, the horses are better fed; they have oats and cut straw, besides clover-hay; and by increasing their work gradually, they soon come to do a good day's work. They are generally at work soon after four in the morning, or as soon as it is light, and work steadily till ten: they are then brought home, the harness is taken off, and they feed and rest till two or three, when they resume their work, and continue at it till six or seven. In harvest-time they work from day-break till evening, resting only a few hours in the heat of the day.

The great object in the Flemish system is to feed the stock at the least possible expense. The generality of the farmers have no meadow-land, and, if they use hay, it is purchased at a considerable price. Potatoes and carrots, of which ten or fifteen tons can be raised on an acre of land, are much cheaper; and, if they require more manure, they also produce more. With oats and cut straw, or wheat-chaff, and occasionally a little clover-hay, the roots keep the horses in very good health, and slow-working condition. The carrots are given raw, but the potatoes are generally boiled, and given mixed with chaff. In every stable there is a cistern constantly filled with water, with some bean-meal stirred into it. This greatly assists the food they take; and it is supposed that meal given in water goes farther than in any other way. If it were boiled to a thin gruel, it would probably be still more nutritious, for then the particles of the starch, which cold water does not dissolve, and which often pass undigested through the stomach, would have given out their gummy contents, and become dissolved in the water. But it is impossible to unite the greatest economy in feeding horses with that condition which enables them to make great and sudden exertions, and which keeps up a high courage. In this case dry oats and good hay are indispensable. In the neighbourhood of Dixmude and Furnes, where there are extensive pastures, the horses are put out to grass in summer, and fed with hay and oats in the stables in winter: straw and clover-hay are cut into chaff to mix with the oats; roots are given occasionally, but do not form the principal part of the food, as they do in East Flanders.

The government has been at great pains to procure fine stallions to improve the native breeds. High prices have been given for some strong, full-bred English horses; but such are the prejudices of the farmers, that, although nothing, or a mere trifle only, was charged for covering a mare, some extremely fine horses were sent into several districts, without any one appearing anxious to avail himself of such an opportunity. They seemed to fear that some invidious design was concealed under this apparent liberality: but, when they find that those who have bred colts of the improved cross have obtained a much better price for them than for those of the old breed, they will probably see their error. If some well-

shaped mares from Yorkshire or Lanarkshire had been imported, as well as stallions, a better breed would have soon been produced, by crossing both ways.

When the British army returned from Belgium after the battle of Waterloo, some fine-looking horses were bought at a very reasonable price, and, from their bulk, were thought equal to our dray-horses. Many were imported into England by dealers who realized great profits; and the Belgians naturally concluded that their breed of heavy horses was better than the English, or else why import them? But this trade is nearly at an end. A few of the best-shaped horses have turned out well, but the great majority of them have disappointed the purchasers. They are slow and heavy, and are not to be compared, for farm or road work, to our active north-country horses, or our Suffolk punches, which much resemble the Flemish horses in colour, and were probably of Flemish origin, improved by careful selection in the breeding.

There are not nearly so many foundered horses met with in Flanders as there are in England, which must be attributed more to their being less severely worked than to their being better shod. The manner of shoeing is heavy; the horses are tied up in a strong frame or cage, to which the foot to be shod is firmly tied, so that, even if he be pricked to the quick by a nail, he can only exert the muscles of his legs in vain, and strain himself; but he can neither escape nor defend himself.

The horses are harnessed with heavy collars and rope traces. The weight of the harness is much increased by making the collar so large; and, as every additional weight must add to the fatigue of a day's work, it is a useless waste of strength; but any attempt at alteration or improvement would, no doubt, be strongly reprobated. The horses used in the towns draw enormous loads on carts and waggons of various descriptions. Some of these have the body of the waggon sunk low between two large wheels, the axletree being bent for the purpose. In front are two small wheels placed near one another, and turning round under a kind of crane-neck, which forms the fore-part of the waggon. This form is very convenient in towns for loading and unloading goods. In the country they use carts and waggons not greatly different from our own. A pair of horses and one plough are thought sufficient for forty acres of arable land, the whole of which is, on an average, ploughed twice, and harrowed three times every year. This alone will give work for above two hundred days, without reckoning the carting of fodder and manure, and harvest-work. The horses should be well fed to stand all this work. The value of a strong young cart-horse is, on an average, about twenty pounds. In England a similar horse would be worth thirty pounds, or more, which accounts for the importation of Flemish cart-horses into England. It is supposed in Flanders that the English dealers buy Flemish mares to breed from, which is a great mistake. Here and there a mare may be found with good proportions, and from her size a breeder might be tempted to give her a good moderately-sized half-bred horse, in hopes of producing strong coach-horses; but the common faults of the breed, the coarse neck, large belly, and falling croup, would probably appear in the progeny, even if the English cross infused some spirit and life into the produce. We are not aware that any good horses have been lately bred from Flanders mares: besides, the dealers buy the geldings in preference, when they can get them. The importation of horses from the Netherlands is therefore a mere speculation, the price being lower there, and the import-duty trifling; but the trade is falling off, in consequence of a rise in the price of good

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horses in Flanders, and a smaller demand for them in England. The most useful horses for work are to be met with in the Walloon country and the provinces of Namur and Luxemburg. Some of these horses, when well fed, have good figures; and this breed would be much better to cross with our active half-bred horses, than the Flemish. They are sometimes found in Flemish farms in preference to their own heavy breed; and the public carriages in Flanders are almost invariably drawn by horses which have been imported from other provinces.

Asses and mules are very seldom seen, which we are surprised at; for an ass might be kept on the very small farms to do the work which is now frequently done by men, such as drawing harrows, wheeling manure to the land, and bringing home the produce. The only use to which asses are put seems to be to carry women and their panniers to market. Those asses, however, which are met with are all in good condition, and show that they have been liberally provided with food, instead of being half-starved on commons and in lanes, as they are often with us.

Chapter XV.

OF GARDENS, ORCHARDS, AND WOODS.

To every farm there is usually attached a good kitchen-garden, which is well stocked with vegetables; and, in situations where the soil is favourable to fruit-trees, there are a few orchards; but none so extensive as in many other countries, where cider is made. This beverage is not much used in Flanders, beer being the favourite liquor; hence the cultivation of fruit-trees is chiefly to supply the towns with their fruit. They are never planted in the hedge-rows, as they are in many other countries, because it induces the children to break the hedges to get at the fruit. But in the neighbourhood of the towns, where fruit can be readily disposed of, every cottage has a little orchard attached to it. The apples, pears, cherries, and plums which it produces help to pay the rent. In some situations walnut-trees grow to a great size, and produce abundant crops, which are always valuable, especially when walnuts are scarce in England, as a considerable exportation of them enhances their price. There is nothing particular in the management of fruit-trees in Flanders. There are not many walled gardens, except near the houses of the richer proprietors, and in the immediate neighbourhood of large towns, as Ghent and Bruges. Wherever there are old convents, good gardens are generally found; gardening having always been a favourite recreation of the monks in their old age.

A considerable extent of woodland once covered the poorer sandy districts about Thorout, and from thence to Bruges, and many other parts of Flanders, of which the soil was formerly not thought worth cultivating. But all these woods gradually disappear as cultivation spreads, and of late years the conversion of woods into arable fields has gone on most rapidly, especially since the coal-mines have been more extensively worked, and the price of wood for firing has diminished. The increase of population and industry will probably soon convert what remains of them into corn-

fields. The most common trees found in old woods are oak, beech, ash, and birch. The plantations of firs are mostly of modern origin, and intended merely as a preparation for the further improvement of the land, as was mentioned before (ch. II. page 11). They are, consequently, of no size, nor of much use as timber. Where woods are properly attended to, it is the custom to prune the trees, and cut off all the young branches which shoot from the stem, to the height of thirty feet or more. When the shoots are quite young, this is done close to the bark, which soon grows over the wound, and the stem has a straight smooth appearance. In this way trees may be left nearer to each other than if their branches spread out; but there is no chance of finding oaks with large limbs, which are so useful for ship-building. In fact, there is scarcely any ship-timber growing in Flanders. The trees are usually cut down at forty or fifty years old; as it is thought, and perhaps correctly, that after that time the growth of an oak does not pay the interest of the price it would have sold for, together with a rent for the land it occupies. The same calculation has caused the white poplar, and other quickly-growing trees, to be preferred to any other for planting in all situations where such trees find sufficient moisture. In the flat and low parts of Flanders, where the water lies very near the surface, and where ditches are necessary to drain the land, as well as to separate fields and properties, the white poplar and the alder are planted on each side of the ditch, generally in the slope, about eighteen inches below the level of the field. These form a fence which is not impervious, and which would be of little use if the cattle were turned out to feed in the fields, as is the case with us; but these hedge-rows are a source of considerable profit to the landlord and to the tenant; the former reserving the trees, and the latter having the liberty of cutting the underwood every seven years. This is so general a practice, that the incoming tenant is obliged to pay to the outgoing the value of all the underwood, which has not been cut the last year, according to its growth; he receiving the same allowance when he quits. This insures the proper care of the fences. The ditches are cleared out as often as there is any deposit of mud sufficient to pay for the expense, which is generally in two or three years. There is no such thing as a raised bank to be seen in all Flanders, except the dykes along the rivers. The earth which is dug out of the ditches is spread over the land on each side, in order to raise it, and, where there is any danger of floods in winter, the ditches are wide and more numerous, in order to raise the land above the floods. In low places the ditches are so near to each other, that they take up a large portion of the land, which lies in narrow strips between them; but this is no loss, as the earth raises the land, and lays it dry, besides deepening the soil: and those strips of land drained by the ditches, and by the trees planted along them, which suck up a great portion of the superfluous moisture, are in general very productive. Where the land lies high and dry, no ditches or hedge-rows are to be seen; the fields and properties are only distinguished by land-marks; and the whole has the appearance of a common field, although no right of common pasture exists over them, except such as is voluntarily given to the common flock of sheep, or to the sheep of the person who keeps a bull and a ram for the use of the parish, as was mentioned before (page 63).

Fences and ditches, where they are not necessary to carry off the water, are considered as taking up ground which may be more profitably cultivated. This is a general notion on the continent, contrary to our invariable practice of enclosing with a hedge and ditch. Fences and hedges are

not only useful to protect the crops from the inroad of cattle or trespassers, but they break the force of the winds, and often prevent the storms from laying the corn. In cold springs also they intercept the sharp, cold winds, and prevent them from nipping the young blade in its tender state. If they intercept the rays of the sun in summer, they do so in a very trifling degree: and, provided there are no high trees in the fences, a neat low hedge will have little effect in retarding the maturity of the crop. Trees in hedge-rows, except poplars, willows, and alders, planted along the ditches for the purpose of drawing up and evaporating the moisture, as is the case in Flanders, although they may occasionally be profitable to a landlord, whose tenants have not made a sufficient deduction from the rent on this account, are always dearly paid for by the injury which they do to the adjoining land. If a portion of the best land were converted into a wood, and well managed, it would repay the landlord better, in the end, than all the straggling trees, which spoil the fences and diminish the annual produce of the land. We are not taking the appearance of a country into the account. The beauty of an English landscape would be much lessened, if the hedge-rows were not furnished with trees; but we are treating of the interest of the farmer, and not of the man of taste or the artist.

Coppice wood is cut every seven, eight, or nine years. A certain number of the strongest stems are left to grow to poles and trees, as is most profitable. In moist situations alders and willows form the principal underwood. Beech, ash, and oak grow in the higher and drier spots. Neither woods nor coppices are thought very profitable, and they are converted into arable fields as soon as there is a demand for land in the neighbourhood.

Chapter XVI.

OF THE SPADE HUSBANDRY PRACTISED IN THE SMALL FARMS IN FLANDERS.

The husbandry of the whole of the north-eastern part of East Flanders, where the soil is a good sandy loam, may be considered as a mixed cultivation, partly by the plough, and partly by the spade. Without the spade it would be impossible to give that finish to the land, after it is sown, which makes it appear so like a garden, and which is the chief cause of the more certain vegetation of the seed. There is a great saving of seed by this practice, as may be seen by comparing the quantity usually sown in Flanders with that which is required in other countries, where the spade is more sparingly used. In large farms in England the spade is only used to dig out water-furrows, and to turn heaps of earth, which are made into composts with different kinds of manure. But in Flanders, where the land is usually laid in stitches of about six or seven feet wide, the intervals, as we observed before, are always dug out with the spade, and the earth spread evenly (*sifted*, as they call it) over the seed which has been harrowed in. The earth may not be of a fertile nature below the immediate surface; sometimes it is only a poor sand, or a hard till; but this is no reason why it should not be dug out. If it is very light and poor, a good soaking with urine, a few days before it is dug out, will impart sufficient fertility to it. If it is very stiff, the clods must be broken as small as

possible in the digging, as is done when stiff ground is trenched in gardens; and what is left unbroken on the surface, and not pulverised by the passing the *traineau* over it, will inevitably be reduced to a powder by the frost in winter. Thus the land is not only kept perfectly drained, but the seed, being covered by an inch or more of earth, is placed out of the reach of birds, without danger of being buried too deep. The soil from the bottom of the trench contains few seeds of weeds, and the root-weeds are necessarily cleaned out in the spreading. This earth spread over the surface of the land keeps it clean, by burying the smaller seeds, which the harrows may have brought to the surface, and preventing their vegetating. It is for this reason that the roller, or the *traineau*, is made to press the surface, or that, in very light soils, men and women tread it regularly with their feet, as gardeners do after they have sown their beds. The trench, which is thus dug, is a foot wide, or, more properly, one-sixth part of the width of the stitch, or bed; and the depth is from a foot to eighteen inches, according to the soil. Thus, a layer of earth about two inches deep, at least, is thrown over the seed, which has been sown on a surface made even by the small harrows, or the bush-harrow. These two inches gradually incorporate with the soil below; and thus, at every such operation, the soil is deepened so much.

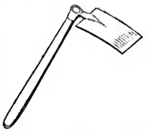
The trenches are so arranged, that every year a fresh portion of the ground is dug out, and in six years the whole land will have been dug out to the depth of at least one foot. In the next course the trench is dug a few inches deeper, which brings up a little of the subsoil; and, after four or five such courses of trenching, the whole soil comes to be of a uniform quality to the depth of eighteen or twenty inches, a most important circumstance to the growth of flax, potatoes, and carrots, all of which are very profitable crops to the farmer, and the two last indispensable to the maintenance of the labourers and the cattle. In the Waes country they proceed differently, for they have a soil which, by repeated trenchings, has long been uniform in quality to the required depth. There they regularly trench one-sixth part of the land every year, and plant it with potatoes, or sow carrots in it. This comes to the same thing in the end, and is, perhaps, a saving, from the fixed price of trenching, and the expertness of the labourers in this operation. But where the land has not yet been so completely deepened, the first may be the most easy method of producing the thorough mixture of the different parts of the soil; besides, it is only done on that part of the farm which is sown with corn, or about half of the arable land; so that it is only the twelfth part of the farm which is thus dug up. There is no doubt that this operation might be done at a less expense of labour by the application of improved implements: thus, a small plough, with one horse, might draw two small furrows, laying the earth into the middle of the divisions between the stitches. This earth might be shovelled out, and thrown on the beds on each side: a second bout of the plough would give the required depth. We would suggest this as an experiment to all occupiers of wet soils, especially where the land has been lately drained. The effect of it would be perceived in a short time, and would perfect the improvement produced by judicious and deep draining, and the use of the subsoil plough. The great point is the expense. It is impossible to calculate exactly what additions this would make to the expense of an acre of land at the time of sowing. At first the price would be much too high; but, as labourers became better acquainted with it, and more expert, there is no doubt but it could be done at a price which would bear the same proportion to the price of corn with us as it does to the Flemish farmer; and, with our ingenuity in performing operations by instruments and machines, which supersede much of the manual labour otherwise required, it might be found not only

highly advantageous to the crops, but also highly economical. A bushel and a half of wheat is an ample allowance to sow an acre, where every grain is protected, and nine out of ten are likely to grow, if the seed has been carefully selected. This, of itself, is a sufficient saving; but the crop will be more certain in a deep dry soil, whatever be the season: and the gradual and permanent improvement of the soil must not be lost sight of. Might it not be judicious in the landlords to make some allowance to those tenants who hold their farms for a short term, if they would adopt this plan, which would be far more effectual than a partial under-draining, which often produces but a very trifling or temporary effect? The landlord will always find that he reaps the principal advantage, in the end, of any method which permanently improves his land. But even the tenant, if he has a lease, of which a few years remain unexpired, will derive a certain profit from this operation, after the first year or two, and this may induce him to try it even without encouragement from the landlord. Let him make the experiment upon a single acre first—the loss cannot be great. Let him keep an exact account of the extra labour and extra produce, as compared with an acre cultivated in the usual way, and the result must be satisfactory one way or other. If this experiment be made in several places, it will at once decide the question, whether this addition to the manual labour of the farm is repaid by the increased produce or not: if it should only balance, without immediate gain, there would be a great advantage in the practice: there would be more employment for men out of doors, and threshing machines and other instruments to diminish labour would not be looked upon with a jealous eye, as depriving the poor man of his bread. Supposing an acre, the length of which is one hundred yards, and the width consequently forty-eight yards and a fraction, divided into twenty stitches, which will make each stitch a little more than seven feet, including the interval, there will be two thousand yards in length to dig out and spread on each side. This, at a penny for twenty yards, would cost only eight shillings and fourpence; and we think it might be done for less, if previously loosened with a plough. The saving of one bushel of seed at seven shillings, the present price (1837), would nearly pay the expense; but suppose the expense to be the double of this, the advantage to the land at the end of a few years would amply repay it. At first it is not likely that the effect would be very striking in the superiority of the crops; but a gradual improvement would be visible, especially in the clover, which strikes its roots deep, and cannot bear a wet or a hard bottom. Heavy lands may thus be made to bear excellent turnips, and admit of folding sheep; while similar lands, not so treated, would not be fit for this root, nor be advantageously folded over, in consequence of the moisture remaining nearer to the surface.

Another application of the spade, in the Flemish cultivation of land, is the deepening of the furrows, by taking out solid spits of the bottom soil in autumn, and placing them on the ploughed part of the land. This, which has been noticed before, as a practice peculiarly Flemish, tends to lighten the whole soil, to mix a portion of the subsoil with it, and gradually deepen it. The spit which is taken out is left to crumble by the influence of the atmosphere; and in winter or in spring the clods are broken and spread by the harrows, and mix with the surface. This operation can only be useful in light loams and sands; for it is evident that in clay the holes thus made, and but loosely filled up, would form basins for the water to collect in, and do more harm than the earth brought to the surface could do good. But the principle is the same, which is to increase the depth of good soil gradually. We would give the preference to the first method, unless where the tenure did not permit the farmer to wait a few years to reap the full

benefit of the operation. The last described is the more immediate in its effects; the former the more perfect and durable.

Instead of the spade an instrument is also much used, which may be considered as intermediate between it and the hoe. It is the *hack*, or heavy hoe, which is used for loosening the soil to a small depth, in order to clear it of root-weeds and annuals, which may have shed their seed before the crop was reaped. It has a blade like a small spade, fixed to a handle three or four feet long, at an angle of about 60° degrees (see fig.). With this instrument the stubbles are cleared, the weeds are cut up, and the land, thus stirred, is prepared, by raking and harrowing only, for sowing turnips or any other crop sown immediately after harvest. The depth thus cultivated is only two or three inches, but the ground is gone over rapidly, and at a less expense than it could be done with a plough at the busy time of harvest. The work is not too heavy for women and boys, who are often seen employed in it: whereas it is very unusual to see a woman at work with a common spade. The same instrument is also used for drawing the earth round the roots of potatoes or of colza, which are seldom moulded up with the plough.



Where the land is cultivated entirely by the spade, and no horses are kept, a cow is kept for every three acres of land, and entirely fed on artificial grasses and roots. This mode of cultivation is principally adopted in the Waes district, where properties are very small. All the labour is done by the different members of the family; and children, instead of being a burden, soon begin to assist in various minute operations, according to their age and strength, such as weeding, hoeing, feeding the cows. If they can raise rye and wheat enough to make their bread, and potatoes, turnips, carrots, and clover, for the cows, they do well; and the produce of the sale of their rape-seed, their flax, their hemp, and their butter, after deducting the expense of manure purchased, which is always considerable, gives them a very good profit. Supposing the whole extent of the land to be six acres, which is not an uncommon occupation, and which one man can manage. One acre is trenched twenty inches deep every year, well manured with the dung and urine of the cows, and planted with potatoes, part of an early kind and part of a later, as the land is ready, from the beginning of April to the end of May. If the soil is fit for wheat, this is usually the next crop; if it is too sandy, rye is sown instead. The taking up the potatoes gives a sufficient tillage for the wheat or rye, which is sown as soon as the potatoes are off, and the seed is covered by digging narrow trenches at six or seven feet distance from each other, and throwing the earth evenly over the seed. The land is rolled, or trodden with the feet, which last is best in light soils. Half an acre of land is usually in carrots, which have either been sown with the flax, or, which is much better, by themselves. The turnips are always sown on a stubble. The land which has borne rye is generally preferred for this purpose, as it is the first crop reaped. They may also be sown with advantage after early potatoes, or after colza. Sometimes oats are sown immediately after harvest, to be cut up green for the cows before winter, or winter barley to cut early in spring. Spurrey is sown for the same purpose; but it is so apt to infest the ground as a weed, that it is only in the very sandy soils that it is much cultivated. Buckwheat is sown when there

is no manure to spare, in order to fatten a couple of hogs for the winter's provision.

The rotations of crops, followed by the small spade farmers, vary extremely, according to the soil, situation, and other circumstances. Hemp, flax, and colza, seldom recur in less than nine or ten years; as they require much manure, and do not succeed if sown too often. Wheat usually occupies a fourth, or a third of the land, rye a sixth, potatoes a sixth, clover an eighth: carrots and turnips are mostly secondary crops, although occasionally sown also as principal crops. The successions are generally as follows:—

In good loam. Wheat after clover, potatoes, or beans.
Rye and turnips after wheat or potatoes.
Oats after turnips or carrots.
Potatoes after turnips, clover, or buckwheat.
Flax after hemp, potatoes, or carrots.
Hemp after turnips.
Colza after flax.
Beans after wheat or clover.
Turnips after rye, barley, or oats, the same year.
Carrots in the rye or the flax, or after clover.
Clover in flax, oats, or wheat.
Winter barley, to cut green in spring, after potatoes.

When any other produce is raised, such as peas, tares, poppies, cameline, beet-root, or parsnips, they only take the place of those crops which are most nearly allied to them, whether pulse, oily seeds, or roots, without altering the succession.

The first object of the spade farmer is to procure food for his cows, for without them he cannot have manure enough. He must not merely have a bare sufficiency for them, but he must have abundance; for, if the food of the cows fails, his whole process is impeded: he must then either sell some of his stock, or buy fodder at a ruinous expense. If he has too much, he will never be at a loss how to dispose of it. He must also have food for himself and his family. It is calculated that each grown individual consumes in the year—

6 bushels of rye		or 12 bushels of grain.
3 ditto	wheat	
3 ditto	buckwheat	
14 ditto	potatoes.	

48 lb. of butter.
1 cwt. of pork.
And 2 quarts of butter-milk, or skim-milk, per day.

If a man with his wife and three young children are considered as equal to three and a half grown-up men, the family will require thirty-nine bushels of grain, forty-nine bushels of potatoes, a fat hog, and the butter and milk of one cow: an acre and a half of land will produce the grain and potatoes, and allow some corn to finish the fattening of the hog, which has the extra butter-milk; another acre in clover, carrots, and potatoes, together with the stubble turnips, will more than feed the cow; consequently two and a half acres of land is sufficient to feed this family, and the produce of the other three and a half may be sold to pay the rent or the interest of purchase money, wear and tear of implements, extra manure, and clothes for the family. But these acres are the most profitable on the farm, for the hemp, flax, and colza are included; and, by having another acre in clover and roots, a second cow can be kept, and its produce sold. We have, therefore, a solution of the problem how a family can live and

thrive on six acres of moderate land. We must next consider how the land is to be tilled by them without any hiring of labour. A good labourer can trench four perches of land, each perch being the square of five and a half yards, in a day, or dig eight perches. It will take him thirty days to trench an acre, and sixteen to dig it well. It will take him, therefore, seventy-eight days' labour to trench one and dig three more acres; one being in clover does not require it, and that which had potatoes before is prepared by digging them up. His wife and children carry the clover, which he cuts after his day's work, and weed the crops. The digging for wheat and rye is done in the autumn, beginning with the land cleared of colza; the hacking the stubble for turnips and sowing them makes a variety in the toil, this not being so laborious. The trenching is done in winter and at any spare time between harvest and spring. The wheeling of manure, harrowing, sowing, digging out water-furrows, and reaping the corn on three acres, will take forty-five days' labour. An acre of potatoes on the trenched ground will require twenty-four days' work to make ridges, plant the sets, mould them up with the hoe, and take them up. The turnips after rye will require eight days to hack the stubble, harrow it, and sow the seed, and four days, with the help of the family, to pull them and wheel them to the root-cellar, for they are never left in the field in winter. Allowing five days for cutting the clover and making a portion of it into hay, we have found work for one hundred and sixty-four days, which, to include various smaller operations, we shall reckon altogether two hundred days' work out of doors. The remainder is amply sufficient to thrash out the produce, prepare manure, assist his wife and children in feeding the cows and pigs, and weave occasionally. The flax, being generally sold standing, and pulled by the buyer in summer, does not interfere with the farmer's labour. The weeding in spring is done by the whole family; and neighbours mutually assist each other.

In a farm of ten acres entirely cultivated by the spade, the addition of a man and a woman to the members of the family will render all the operations more easy; and with a horse and cart to carry out the manure, and bring home the produce, and occasionally draw the harrows, fifteen acres may be very well cultivated. Mr. De Lichterfelde has given a calculation of the expense of cultivating such a farm, and the average produce, which, as being on good authority, we shall subjoin with some remarks. The cultivation here is supposed to be carried on by hired labour:—

TABLE of EXPENSES and PRODUCE in the Cultivation of 15 Acres of Land by the Spade, with a Horse to carry Manure and Produce.

No. of Acres.	Rotation. 1	Rotation. 2	Rotation. 3	Rotation. 4	Average Produce.	Aver. Value.	Total value in Florins	Number of days' labour. Men. At 14 sols Brabant.	Men. At 13 sols.	Women. At 10 sols.	Manure. Cart-loads of Dung, at 6 fl.	Manure. Casks of Liquid, at 12 sol.	Manure. Measures of Ashes, at 12 sol.	Seed.	Total value in Brabant money.
1	Oats.	Clover.	Colsa and Potatoes.	Wheat.											
1	Oats.	Clover.	Colsa and Potatoes.	Wheat.	30 sacks 9000 lbs. of Straw	9fl. per sack 1 liard par lb.	382 10	93¾	30	48	. .	90	. .	¾ sack	fl169 17 6
1	Rye and Turnips.	Carrots.	Flax.	Wheat.											
1	Clover.	Colsa and Potatoes.	Wheat.	Rye and Turnips.											
1	Clover.	Colsa and Potatoes.	Wheat.	Rye and Turnips.	30 sacks 12000 lbs. of Straw	5fl. 1 liard	300 0	93¾	30	30	. .	90	. .	¾ sack	156 0 0
1	Carrots.	Flax.	Wheat.	Rye and Barley.											
1	Flax.	Wheat.	Rye and Turnips.	Buck Wheat,	10 sacks 2000 lbs. Straw	5fl. ¼ liard	56 5	30¼	. .	12	. .	. .	. .	4 pts. at 3s. 3l.	28 5 6
1	Colsa and Potatoes.	Wheat.	Rye and Turnips.	Oats.	40 sacks 6000 lbs. of Straw.	4fl. ¼ liard	197 10	63¼	20	20	16	. .	. .	1¼ sack	169 9 0
1	Wheat.	Rye and Barley.	Buck Wheat.	Oats.											
1	Wheat.	Rye and Turnips.	Carrots.	Flax.	Sold standing.	. .	210 0	31	. .	80	. .	30	. .	30 pts. at fl1 10	124 14 0
1	Buck Wheat.	Oats.	Clover.	Colsa and Potatoes.											
1	Rye and Turnips.	Oats.	Clover.	Colsa and Potatoes.	20 sacks Straw, at	20fl. 12fl.	424 0	104	. .	30¼	8	60	. .	4 pts. at 15s.	175 1 0
1	Colsa and Potatoes.	Wheat.	Rye and Turnips.	Carrots.	value per perch, 6d.		90 0	30¼	. .	16	8	. .	. .	1¼ pt. at 6l	79 0 6
1	Rye and Turnips.	Buck Wheat.	Oats.	Clover.											
1	Wheat.	Rye and Turnips.	Oats.	Clover.	value per perch, 8d.		240 0	16¼	. .	. .	. .	. .	60	3 pts. at 62 10	47 11 0
15															
SECOND CROPS. 2 acres Turnips, valued					. . . .	. .	120 0	54¼	. .	16	. .	. .	. .	1¼ pt. at fl1	47 13 0
1 do. Barley, cut green, valued					. . . .	. .	73 0	28¼	. .	. .	8	. .	. .	¼ sack at fl5	70 5 6
2 do. Potatoes					200 sacks	f.1 5	250 0	89¼	. .	12	12	60	. .	3 sacks 61 5	190 8 0
5 acres							2345 5	635¼	80	264¼	52	330	60		fl1248 5 0

REMARKS.—The florin (fl) is 20 sols (s); the sol 4 liards (l).—The sack is nearly 3 bushels imp. meas.—14 florins make £1 sterling.—A pinte (pt) is nearly an English quarter-peck.

DISTRIBUTION of the LABOUR on the FOREGOING FARM, per Acre.

Wheat after Potatoes or Flax, or Rye after Wheat.

	Days' Work. Men	Days' Work. Women.
Digging and forming beds	20	0
Carrying liquid manure and spreading	1	0
Sowing the seed	0½	0
Harrowing in	2	0
Digging out the intervals, and spreading the earth over the seed	2½	0
Treading in the seed	0	6
In Spring.		
Weeding	0	8
Harvest.		
Reaping	2½	0
Tying the sheaves	0	2
Loading	1	0
Stacking	2	0
Total	31½	16

Buckwheat after Barley, cut green.

	Men	Women
Digging, sowing, harrowing,	22½	0
Weeding	0	8
Mowing	2	0
Gathering and carrying to thrashers	0	4
Thrashing in the field	3	0
Cleaning, winnowing	1	0
Loading and carrying straw	1	0
Stacking	1	0
Total	30½	12

Oats after Turnips.

	Men	Women
Carrying 8 loads of dung	1	0
Spreading	1	0
Digging, harrowing, and sowing	22½	0
Rolling	2	0
Weeding	0	8
Harvesting as for wheat	5½	2
Total	31¾	10

Oats after Buckwheat.

	Men	Women
Same as the preceding	31¾	10
Digging the intervals, and spreading the earth over the beds	2½	0
Total	34¼	10

Flax after Carrots.

	Men	Women
Before Winter.		
Digging out spits of earth from the intervals, and placing them on the beds	2½	0
In Spring.		
Spreading	1	0
Digging	20	0
Carrying liquid manure	1	0
Harrowing repeatedly	2	0
Sowing	0¼	0
Bush-harrowing the seed	2	0
Rolling	2	0
Weeding	0	80
Total	30¾	80

	Days' Work. Men.	Days' Work. Women.
Colza after Clover or Potatoes.		
Before Winter.		
Preparing a bed to raise plants	0½	0½
Carrying 4 loads of dung	0½	0
Spreading	0½	0
Deep trenching	30	0
Taking up young plants and making holes for planting	4	0
Putting the plants in the holes, and treading the earth to them	0	4
Digging spits out of the interval, and placing them between the plants	3½	0
In March.		
Carrying liquid manure	1	0
Weeding	0	8
Harvest.		
Cutting the stems	4	0
Carrying them to the thrashers in the field	0	2
Thrashing	5	0
Cleaning	1	0
Tying up the straw	0	1
Loading and stacking	3	0
Total	53	15½
Carrots after Turnips.		
Digging, harrowing, and sowing, as for oats	22½	0
Spreading earth over the seed	2¼	0
Weeding	0	8
Taking up the crop	4	0
Collecting and cutting tops	0	8
Securing them in pits with straw and earth over them	2	0
Total	30¾	16
Clover.		
Sowing amongst the oats or wheat	0¼	0
Spreading ashes after harvest	1	0
Mowing twice next year	5	0
Tying up in bundles, and carting	2	0
Total	8¼	0
Turnips after Rye.		
Digging, sowing, and harrowing	22½	0
Weeding and thinning out	0	8
Pulling and carting	5	0
Total	27½	8
Winter Barley after Rye, to cut green.		
Before Winter.		
Digging	20	0
Carrying 8 loads of dung	1	0
Spreading dung	1	0
Sowing	0¼	0
Spreading earth out of intervals over the seed	2½	0
In Spring.		
Cutting and carrying	3½	0
Total	28¼	0
Potatoes after Colza or Barley, cut green.		
Digging and drawing furrows with the large hoe	30	0
Carrying six loads of dung	0¾	0
Spreading dung in the furrows	2	0
Cutting the sets	0	1
Placing them in the furrows and covering them	2	2
Carried forward	34¾	3

	Days' Work: Men.	Women.
Brought forward	34¾	3
When they are up.		
Carrying liquid manure	1	0
Pouring it to the plants	2	0
Hoeing and moulding up	3	0
In Autumn.		
Forking up the potatoes	3	0
Gathering them	0	3
Loading and carrying	1	0
Total	44¾	6

RECAPITULATION.

	Men.	Women.
For wheat or Rye	31¼	16
Buckwheat after barley, cut green	30¼	12
Oats after turnips	31¾	10
Oats after buckwheat	34¼	10
Flax after carrots	30¾	80
Colza after clover	53	15¼
Carrots after turnips	30¾	16
Clover	8¼	0
Turnips after rye	27¼	8
Winter barley after rye	28¼	0
Potatoes after winter barley, cut green, or Colza	44¾	6

The total value of the produce is here stated at 2345 fl. 5s. which, at 14 florins per £., is 167*l.* 10*s.*, or 11*l.* 10*s.* per acre. Wheat is worth in Flanders on an average 35*s.* per quarter, and a man's daily wages are 10*d.*, without food, in summer, and 9*d.* in winter. We have given the table without alterations, although we are aware that it appears imperfect; for although the keep of a horse is mentioned, it is not included in the expenditure. The straw, green crops, and roots, are valued, no doubt, after minute calculations, but it does not appear whether the produce of the stock is only equivalent to the food consumed, or gives a profit; a matter of great importance. To correct this we will make another calculation on the same basis; and, to make it more intelligible to the English reader, we will put the prices as they are now in English money. The 29,000 lbs. of straw will produce, at 500 lb. of straw for a cart-load of dung, fifty-eight cart-loads; four cows and a heifer constantly kept in the stable will give, with the washings of the stables, at least twenty gallons of liquid manure daily, that is, three hundred and sixty-five casks of twenty gallons each in the year. Thus the manure is accounted for; and, if any is purchased, it may be expected to be at least repaid by the increase of produce above the stated average. The crops raised chiefly for the stock should be valued by the produce of that stock, and we will show that it is fully sufficient for the purpose. Two acres of clover contain three hundred and twenty perches, which are cut twice. Each cow will consume half a perch a-day of the first cut, and two-thirds of a perch of the second cut; that is, fifteen perches per month of the first and twenty of the second. The two acres will, therefore, keep six beasts, including the horse, who eats less than a cow, three months and a half, and the second cut two months and a half more, if no hay is made; but if an acre of the first cut is made into hay, and an acre of barley cut green is given early in summer in its place, there will be two tons of hay for winter fodder. Two acres will produce at least fifteen tons of potatoes; two acres of turnips will average about ten tons each, although sown after harvest; and one acre of carrots fifteen tons. If a cow consumes 40lb. of turnips, and 20lb. of potatoes, and the same quantity of carrots per day, made into a *brassin*, she will require in six months, or one hundred and eighty-three days, 7320lbs. of turnips,

3660lbs. of carrots, and 3660lbs. of potatoes: and five cows will consume 36,600lbs. (nearly 16 tons 7 cwt.) of turnips, 18,300lbs. (8 tons 3½ cwt.) of carrots, and 18,300lbs. (8 tons 3½ cwt.) of potatoes. It appears, therefore, that there is ample provision for the cows kept, with a considerable surplus for the pigs. The horse will have two tons of clover-hay and a little corn occasionally, not exceeding twenty bushels in the whole year, which must be deducted from the produce of the oats. This calculation is made merely as a proof that the quantity of food raised for the cattle is more than sufficient for their maintenance. The common mode of calculation in Flanders is by the *verge*, of which there are three hundred in a Ghent acre, which is about one-ninth greater than the statute acre. It is this acre which the table refers to. A verge of clover, carrots, or turnips, is considered sufficient for a day's food for a cow. An acre will, therefore, keep her three hundred days, and, as we have one acre of clover, and one acre of barley cut green, two acres of turnips, and one of carrots, the produce will keep five cows three hundred days; so that there will be required as many potatoes as will keep five cows sixty-five days, which, at half a bushel per day for each cow, will be one hundred and sixty-two bushels and a half, a quantity which, in good land, may be raised on half an acre. This mode of calculation gives so nearly the same result as the former, that they confirm each other.

It is evident, then, that fifteen Ghent acres of light land of moderate quality may be kept in good condition by the foregoing plan of cultivation by the spade, with the help of a horse and cart, and will maintain four milch cows and a heifer, a horse, two or three pigs, and a couple of young calves, sending to market or consuming in the family the following produce, deducting seed:—

90 bushels of wheat, at 7*s*.	£31	10	0
90 bushels of rye, at 4*s*. 3*d*.	19	2	6
30 bushels of buckwheat, at 4*s*.	6	0	0
100 bushels of oats, at 3*s*. (leaving 20 bushels for the horse)	15	0	0
An acre of flax, supposed worth	20	0	0
60 bushels of rape-seed, at 6*s*.	18	0	0
8 cwt. of butter from four cows, at 5*l*. per cwt.	40	0	0
Two fat hogs, at 7*l*.	14	0	0
A heifer and two calves sold annually	8	0	0
	£171	12	6

The expenses on the farm, reckoning labour at the rate paid for it in the dearest parts of England, will be as follows, according to the table of labour:—

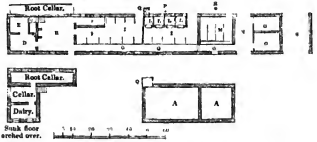
635 days of men in summer, at 2*s*.	63	10	0
80 ditto in winter, at 20*d*. (thrashing)	6	13	4
264 ditto of women at 10*d*.	11	0	0
180 bushels of peat-ashes, at 4*d*.	3	0	0
200 rape-cakes for the flax, at 2*d*. (6*l*. a-ton)	1	13	4
Extra expense in harvest, beer, &c.	2	3	4
	£88	0	0
Remains for rent, interest of capital, profit, &c.	83	12	6
	£171	12	6

The buildings required for such a farm are not expensive. The dwelling-house generally consists of a large kitchen and two bed-rooms, of a dairy, partly under ground, and a cellar for keeping roots in winter. The barn and cow-house are often placed at right angles to the dwelling-house, and, with some open sheds, enclose a yard. But the cheapest plan is that given

in the annexed figure, where the whole is under one roof. The urine-tank is the most essential part, and will appear very large for so small a farm.

Fig. 1.—*Front Elevation.*

Fig. 2.—*Ground Plan.*



A A, urine tank, under the stable and cow-house, 50 feet by 20, and 8 deep, with a partition in it.
B, kitchen.
D and E are sleeping-rooms raised a few feet above the kitchen and over the dairy and cellar.
F, a work-shop for weaving and other work.
G, passage to feed the cattle.
I I, cow-house.
L L, pig-styes.
M, stable.
N, barn floor.
O O, bays.
P, pump for urine.
Q, privy.
R, pump for water.
S, cart shed.

Thus, it will be seen that, by spade husbandry, an industrious man, with a small capital, occupying only fifteen acres of good light land, may not only live and bring up a family, paying a good rent, but may accumulate a considerable sum in the course of his life. The Flemish farmers and labourers live much more economically than the same class in England: they seldom eat meat, except on Sundays and in harvest: buttermilk and potatoes with brown bread is their daily food. Accordingly they are gradually acquiring capital, and their great ambition is to have land of their own. They eagerly seize every opportunity of purchasing a small farm, and the price is so raised by the competition, that land pays little more than two per cent. interest for the purchase-money. Large properties gradually disappear, and are divided into small portions, which sell at a high rate. But the wealth and industry of the population is continually increasing, being rather diffused through the masses than accumulated in individuals. An Englishman with a capital of 100*l.* might cultivate such a farm advantageously, and, if he is satisfied to live as a labouring man, would have the same advantages as the Fleming. His own labour is valued at twelve shillings a-week, his wife's at five shillings, and if she is not always at work his children make up for it. The rent of fifteen acres of land, with a house, cow-house, and small barn, could not be less than 40*l.* a-year, tithe free, and rates and taxes may amount to 5*l.* more; still he would have 38*l.* 12*s.* 6*d.* for his risk, capital, and superintendence, or about one-fifth of the gross produce, which is as much as a farmer on a larger scale could expect, without being paid for his personal labour. In Ireland, where there are many farms of less than fifteen acres, the Flemish system would soon raise the class of small farmers to competence, if they would

only expend the money which now pays for whiskey in forming a urine-tank, and raise artificial grasses and roots for their cows and pigs, instead of trusting to potatoes alone, and over-cropping the land with them. There is some resemblance in the principles of Irish and Flemish cultivation with the spade. The lazy beds for potatoes have the intervals dug out and spread over the beds. The Irish are accustomed to dig and trench ground; they already can live on buttermilk and potatoes; and the cultivation of flax is familiar to many uf them. Give them but a taste for cleanliness and comfort in their habitations, and decency in their dress, and they will soon emulate the Flemish peasant in his industry and independence.

The fureguing account of the spade husbandry of Flanders has been obtained by inspecting many small farms, and comparing the practice of the occupiers. The calculations uf produce and expenses are partly taken from a report made to the French government, in 1812, by Mr. de Lichtervelde, then adjuint-maire of Ghent, in answer to questions sent to him respecting the agriculture of East Flanders, which then furmed a department of France, and partly frum a small work of his, published in 1826, called 'La Beche, ou la Mine d'Or de la Flandre Orientale.' It is always extremely difficult tu calculate the labour on a farm, so as not to fall short of, nor to exceed, what is absolutely necessary. The amount of produce and profit may be nearly averaged from actual accounts, but the effect of additional manure or improved tillage cannot always be reckoned. The quantity of produce stated in the table is certainly not extraordinary, being the same as is produced on a farm cultivated with the plough; and if it were nut that the land where the spade husbandry has been chiefly introduced is mostly of a poor sandy nature, we should say that it was below the average. In better land, such as in the good loams near Courtray, the spade would produce much more wonderful effects, and the heavier the soil, provided it be of a friable nature, the better fitted it is to be cultivated by the spade. Many an acre of land in Britain and Ireland, which now only bears indifferent grass, might be rendered most productive by being converted into a garden by the spade.

Chapter XVII.

AN ACCOUNT OF SOME SELECT FARMS.

The details of Flemish Husbandry cannot be better explained than by reference to a few of the best-cultivated farms in different parts of the country. There is a great uniformity in the general practice, but there are considerable variations introduced in consequence of the diversity of soil and situation. One of the first farms we shall notice is situated within a mile of Courtray, and is in the occupation of a man who has more theoretical knowledge of agriculture than most other Flemish farmers: he is a native of France, but has passed a great part of his life in Flanders; and his wife, who seems very active and well acquainted with the details of a farm, especially the dairy, is a Flemish woman. The place where the farm is situated is called Walle. The extent is thirty-six bonniers, each bonnier being about three acres. The soil is a good sound loam, which, although it is there called a strong soil, would not be reckoned very heavy in those counties in England where the clay prevails. It is such land as may be seen in some parts of Essex and Hertfordshire, which will produce good beans, without being too heavy for turnips, or even carrots. The quality of the soil does not vary materially through the farm. It is not of so rich a

nature as the clays of the polders, and, when washed, contains a considerable portion of silicious sand; but it has been enriched by repeated and ample manuring, not only by the dung and urine of the cattle kept on the farm, but by purchased manure of every description, especially the sweepings of the streets of Courtray and the emptying of privies.

The farm-buildings are very conveniently arranged at a small distance from the high road, from which there is an approach by an avenue of trees. The farm-house, which is substantial and convenient, and the stables for the horses, occupy one side of a square or rectangle of sixty yards long by fifty wide. Opposite the house stands a roomy barn, and another occupies two thirds of the west side of the square. The east side is taken up with a cow-house, ox-stalls, and other useful buildings. The entrance is by a gate-way with double gates, at the north-east angle of the yard. A paved causeway ten feet wide runs all round the farm-yard, raised about eighteen inches above it. The cow-stalls, barns, &c., are on a level with this causeway; and the yard slopes gently towards the middle, where there is an oval tank surrounded by a brick wall, which rises two feet above the yard. There is an opening in this wall sufficient to allow a cart to be backed into it: from this opening the bottom slopes to the further end, where it is three feet deep. This is the *croupissoir*, into which all the liquid part of the dung runs, when it is washed by the rain, through openings left in tho wall which surrounds it. The urine is collected in another large vaulted reservoir immediately under the cow-house and ox-stalls.

This description applies equally to most of the farm-yards attached to large farms; for one hundred and twenty acres is a large farm in Flanders.

Thirty cows are constantly kept on this farm, and six horses, besides young heifers and colts. The cows are always kept in the stalls, and fed with green food in summer, and roots with meal in winter. Each cow has a stall in which she is tied up by herself, separated from the next by a large flat slab of stone about four feet square set on edge. There is a low stone trough before her, and an opening in the wall to give her air. She is tied by a leather strap round her neck, with a chain fastened to a staple, which goes through the wall and is secured by a nut and screw on the other side. The cow-stable is forty yards long without any division, and six yards wide, so that there is much room behind the cows. In the middle against the wall is a pump to supply water for the cows and to wash out the stable, which is very frequently done, the whole being swept into the urine-tank below through an aperture, towards which all the gutters slope from the cow-stalls. Under the pump is a stone cistern, which is constantly kept full, that the water may acquire the temperature of the air. In this cistern bean or rye meal is mixed, in the proportion of a large double-handful to three gallons of water, so that the cows never drink the water without this addition. It is supposed to increase their milk and make it richer. Outside of the building is the pump, by which the urine is raised to fill the casks in which it is conveyed to the land. Another pump is in the centre tank, by which the dung water is raised, either to mix with the urine when rape-cakes have been dissolved in it, or to pour it over the solid dung to accelerate the putrefaction. The pens for fattening calves, as described (page 62), are placed along the wall behind the cows, and, being only two feet wide, take up very little room; there are only two or three of these, for, so near a considerable town, the fatting of calves is not so profitable as selling fresh butter.

A few acres of grass are kept in permanent pasture near the house, and the cows are put there for a few hours every day in summer, more for exercise and for the sake of their health, than for grazing. All the rest of the

land is arable, and cultivated very strictly according to a regular rotation. Mr. Doutreluinge, the occupier, informed us, that he had several times made experiments by varying the usual course; at one time increasing the quantity of flax, and at another that of colza: but he found, by keeping very exact accounts of the expense and produce, that every deviation caused a loss in the end. The rotation is very simple. The whole of the arable land he divides into six parts—one part is half in flax and half in colza, one wheat, one rye and turnips, one oats (five-sixths of which with clover-seed), one clover, with a small proportion in potatoes and carrots, one two-thirds wheat and one-thirds beans.

The land intended for flax is ploughed soon after harvest with a very shallow furrow, or only well harrowed to destroy the stubble; rotten dung is spread over it, at the rate of twenty large loads per acre, about the month of September. It is left spread on the land for some time, and then rolled with a heavy roller: this is to press it into the ground, and make it fine. It is then ploughed in with a shallow furrow. When the plough has made a furrow, six or eight men with spades dig spits of earth out of the bottom of it, which they set upon the part already turned up, so that the ground is partially trenched. The plough on its return fills the holes thus made, and, when the whole is finished, it lies in a very rough state with large clods all over it: so it remains all winter. In spring, when the clods are pulverized by the frost, the harrows pass over repeatedly and level the surface. The land is then ploughed and harrowed several times, till it is thought sufficiently fine. Liquid manure is now put on. This consists chiefly of the emptyings of privies and the urine of cows, and also of rape-cakes dissolved in urine, and left to ferment for some time, which is done in the open tank in the yard. The quantity of rape-cake used depends on the supply of *vidanges*, which are preferred, the other being only a substitute. This is allowed to soak into the ground for a few days. It is then well harrowed, and the linseed is sown at the rate of about three bushels to the acre, and covered by the harrows reversed or the traineau. The only peculiarity in this process is the spreading of dung over the land and letting it remain some time before it is ploughed in. According to the prevailing opinions, we should say that a portion of it must evaporate and be dissipated. But the practice must not be hastily condemned on mere theoretical principles. It is well known that there is no manure so good for flax as that which is collected in the towns by poor people, who sweep the streets, and make composts of everything which is capable of putrefaction. This compost is sold, in a dry state, by measure; and we have repeatedly seen the preparers of this manure spread it out in dry places in the sun to bring it to a marketable state. Probably the origin of this may have been that, by being dry, the carriage of it is lighter; but that the virtue of the compost is not lost by drying appears from the reputation it has amongst the farmers, who piously believe that its extraordinary effects are to be ascribed to a peculiar blessing of God, as it enables the poor and destitute to gain a livelihood. It must be recollected that this manure is so prepared by repeated turning and watering, and that the vegetable fibres in it are almost entirely decomposed. It is probable that in drying nothing is evaporated but simple moisture. This practice being peculiar, and not very generally adopted, renders it more deserving of notice.

A little beyond Courtray along the Lys, towards Menin, is a farm particularly noticed by Mr. Radcliffe in his report of the husbandry of Flanders. It was then in the occupation of a Mr. Van Bogeart, who afterwards retired with a competent fortune, chiefly acquired by farming. It is

now occupied by Mr. De Brabanter, who cultivates it very carefully, with some slight deviations from the practice of his predecessor. This farm is called Vollander, and is one of the finest and most compact we have seen. It consists of about one hundred and forty acres, of which about twenty are fine meadows along the river, occasionally flooded in winter, but not irrigated; about ten acres are rich heavy land, adjoining the meadows, in which beans and wheat thrive well; all the remainder, about one hundred and six acres, or rather more, lie in an oblong field bounded by a hedgerow, at one corner of which, nearest the river, stand the farm-buildings. A road or path, six feet wide, runs through the middle of the field, and the road which leads to the farm-yard skirts one end of it. The soil of this field is a rich light loam, which lies over a substratum of clay, but at such a depth as to be perfectly sound and dry. It is not extremely fertile in its own nature, but has been rendered so by many years of an improving husbandry. Every part of the land has been repeatedly trenched and stirred two or three feet deep; and the immense quantity of manure, chiefly liquid, put on year after year, has converted the whole into a very rich mould. The strength and vigour of the crops bear witness to the goodness of the husbandry. As we walked along the middle path, which is just wide enough to admit the wheels of a cart, the whole produce might be seen at once. It was just the time when the flax had been pulled, and remained stacked on the ground. The colza had been beat out, but the stems remained in heaps where they had been cut. There were fifteen acres of most beautiful flax of a bright straw-colour, snd the stems a yard long. This, besides the seed, was worth in the stack from 25*l.* to 30*l.* per acre; twelve acres of colza had produced about fifty quarters of seed; eighteen acres of oats looked so promising, that they could not be set at less than nine quarters per acre; eighteen acres of wheat, which stood well with short but plump ears, we valued at five quarters per acre; eighteen acres of rye, partly cut, with the straw above six feet high, would probably produce rather more than the wheat. There were six acres of white poppy, of which every plant was strong and upright, and the ground under it as clean as a garden: we are no judges of this crop, but we were informed that the expected produce would be about seven or eight hectolitres (twenty to twenty-three bushels)* per acre: six acres were in potatoes, expected to produce eight hundred hectolitres (two thousand two hundred and seventy bushels:—three hundred and seventy-eight bushels per acre). A small patch, about an acre, was in carrots, which looked fine and large; twelve acres were in clover, nearly the whole of which was cut green to give to the cows and horses; it produces three good cuts in the year where it is not allowed to go to seed. The ten acres of heavy land were partly in beans and partly in wheat.

Thus we have one hundred and sixteen acres all profitably cropped, leaving four acres for the roads and farm-buildings. Although this farm is within two miles and a half of Courtray, the greatest part of the manure is collected on the farm. Rape-cake is used most profusely, and to this, as well as to the depth of the soil, the beauty of the flax is ascribed. Mr. De Brabanter usually sows his flax after oats, which, on this account, have been very highly manured. His urine-tank is very capacious, like a large cellar under his cow-house. The farm-buildings are arranged nearly as those of the last-described farm; he has a large dry vault to store his roots in winter. His stock consists of twenty-seven cows in milk, five or six heifers, nine horses, and three colts. The rent of this farm, including land-tax and other imposts paid by the tenant, amounts to 4880 francs,

* A hectolitre is 2·837 Winchester bushels.

187*l.* 15*s.*, which is fully equal to 270*l.* in England, taking the value of agricultural produce in the two countries as a measure.

There is nothing very peculiar in the practice of Mr. De Brabanter. He ploughs the land well, lays it in narrow stitches with deep intervals dug out by the spade, puts manure with every crop, more or less, keeps the land clean by weeding, and adopts a long and varied rotation.

The beauty of this farm consists in the equality of the soil of the great field and its depth. This is not so much owing to natural advantages, as to a long course of stirring and manuring, by which there is such an accumulation of humus, as to render a sandy loam, naturally of moderate fertility, equal to old garden-ground, absorbent and retentive of moisture, without being wet. The labourers on this farm were mostly lodged and boarded in the house, and they had all the appearance of being healthy and well fed. The farmer himself is a tall athletic man, with a good-natured, but shrewd countenance; he seemed very ready to give every information respecting his farm. His wife, equally active, superintends the dairy, and took some pride in showing us in a cool vaulted cellar numerous pans set on the brick floor filled with the last milking, and deeper vats in which the milk of the preceding day had been put in its progress towards churning. The milk, even when it is not intended to be skimmed, is always set in shallow pans for twelve hours before it is poured into the vats, and the different milkings are kept separate.

The next farm which we shall notice is somewhat different from the two preceding, and if the land is not quite so carefully tilled, it is made very productive from the quantity of stock kept upon it. It is situated between Furnes and Dixmude, at a place called Stuiveskenkerke. It partakes of the nature of a polder farm; for the land may be considered as an old polder. The extent of the farm is considerable, upwards of four hundred acres, of which two hundred are in rich natural pastures, the remainder is cultivated with the plough. The soil is here a good stiff loam, having the appearance of a clay; but it approaches more nearly to a marly soil, which crumbles when moderately wetted. It contains a considerable proportion of calcareous matter mixed with sand and clay, and is decidedly of a superior quality to that of the two preceding farms. It requires less manure, but is more difficult to cultivate; both the extremes of wet and dry in the weather rendering the plough useless. In the first case the surface is converted into mud, and in the latter it cannot be ploughed; for if sufficient strength were applied, it would rise in large clods, which would harden in the sun, and remain so till continued wet or frost crumbled them again. Wheat and beans are principal crops, and the latter are more carefully cultivated than we have seen in any other part of Flanders: they are planted in rows, in imitation of the kitchen-gardeners. A drill is drawn with a hoe, and beans are deposited in it three or four inches apart; the earth out of the next drill serves to cover the seed. The distance between the drills is about ten inches or a foot, which in rich land is too near. When the beans are out of the ground the intervals are hoed. The produce is from three to five quarters per acre, but might be more with wider intervals, and more effective hoeing.

The rotation of crops on this farm is generally—1, fallow; 2, winter barley; 3, beans; 4, barley or wheat; 5, beans, clover, potatoes; 6, wheat; 7, oats. The fallows are not ploughed before winter, but four times in spring and summer. Thirty cart-loads of manure in a long state, without the straw being much decomposed, are put on before the last ploughing, and the winter barley is sown in October: the produce is eight quarters per acre. Wheat on the same preparation produces from four to five

quarters, so that the land is better suited for barley, and this last gives a better return with less exhaustion of the soil: every year a small portion of the pasture is broken up, and sown with colza. This would probably not have been permitted, had the farm not been occupied by the son of the proprietor.

The natural fertility of the soil is shown by the succession of crops produced on the newly-broken-up land without any manure; viz., colza, wheat, beans, barley, beans, wheat, clover, wheat, beans, oats. After this scourging it is no wonder that the soil wants rest; and this is given without much care, by merely allowing the natural grasses to spring up without the trouble of sowing the seeds. It takes three years before there is any tolerable pasture; but, as it remains twenty years or more in grass before it is broken up again, the deteriorating effect of the cropping is not observed. How much more productive might not the land be made by more judicious management! The whole of the farm has repeatedly undergone this process, and must have been extremely rich at first. At present it requires repeated manuring to produce even average crops, except on that portion which has been broken up from old grass. Under a regular and judicious course of convertible husbandry, this land might be kept up in the highest state of fertility, and the ultimate profit would be much greater.

If we cannot altogether praise the management of the arable land, we must do justice to that of the dairy and stock. Here the finest and richest butter in the world is made. The stock consists of twenty-four milch-cows, twenty-eight yearling calves, twenty-eight two-year old heifers and steers, and fifty bullocks. All these are wintered on straw, hay, and split beans. The straw is cut into chaff, and the farmer, Mr. Graeve, son of the proprietor, a spirited young man, has procured from England a machine for cutting chaff, which is to be worked by a horse, in the same mill by which he churns his butter. The bullocks are fattened on the pastures, and are fit for the butcher by the end of July or August. The weight of the carcase, when slaughtered, averages ninety stone, of eight pounds each, and sells for 12*l.*, or 2*s.* 8*d.* a-stone. The cows give each, on an average, twelve quarts of milk per day. He churns three times a-week, making forty pounds at each churning. The cream only is churned in a barrel-churn, which is turned by a horse. The butter comes in one hour and a quarter in summer; in winter it takes two or three hours. As soon as it is taken out of the churn it is well washed, to get all the butter-milk out, and immediately salted: before night it is worked again, and more salt is added. It is then put into the cask, and brine is poured over it. It sells for one franc (10*d.*) the pound of twenty ounces. This butter is famed for its keeping, and is therefore much sought after for ships' provision. In summer there are fifty labourers on this farm, half of whom are boarded and lodged, and have from 8*l.* to 12*l.* yearly wages. The day-labourers have 9*d.* a day and their food.

The calves which are reared, of which there were twenty-eight when we visited the farm, have per day a bushel of oats and eight oil-cakes amongst them, with hay and cut straw, from November to May. The fifty oxen have a sack of beans per day amongst them, and cut straw as much as they can eat. There were two hundred sheep, which are folded on the fallows, and, in the day-time, feed in the pastures and along the canals and dykes. When they are fat they are sold, and others bought in. None are bred: for, when kept long on this land, they become subject to the staggers and the rot in winter and spring; they are therefore fattened and sold as as soon as possible.

The breed of pigs was much better than the generality of Flemish pigs, and appeared to have had a foreign cross, perhaps of a Berkshire hog; but there was no distinct account of this. The short legs and pricked ears clearly proved them not to be indigenous.

The cows are dry for three months in the year; at that time they have only straw to eat, with a small quantity of meal diffused in the water they drink. They calve in April or May, and, when the grass becomes abundant, each cow is expected to give five pounds and a half of butter weekly; and, as the pound is of twenty ounces, this is a large average, and shows good pasture.

Hay is made more carefully and better stacked on this farm than we have seen it on any other. The ricks are square, as they are in England, and hold from forty to fifty tons of hay: they are carefully thatched, and want only the pulling and trimming of the ricks in Middlesex, to vie with them in neatness.

There are seventeen horses kept for farm-work; these are mostly of a French breed, much more active and vigorous than the heavy Flemish horses. A good horse costs from 16*l.* to 20*l.* The cows are mostly Dutch, and cost from 8*l.* to 10*l.* each. They are large and have fine udders. The colour is generally black and white, the horns moderate, and the skin fine. They are not so high as the Holderness cows, but their carcases are as large; some of them give an astonishing quantity of milk.

This is one of the largest farms in Flanders, and may be considered as an intermediate between the upland farms and the polders. The buildings are scattered and irregular. It was formerly the property of a religious order, but confiscated and sold at the Revolution in 1794. The chapel still remains, but it is converted into a barn. The tenant purchased the land for a small sum compared to its worth, and his son is the present occupier. A small canal winds through the property, acting as a drain for the superfluous water, and at the same time as an easy means of conveying the produce to the farm-yard, and taking manure to the fields bordering upon it. With a little attention it is not difficult to make this farm produce everything that a frugal Flemish family requires, and enable the occupier to lay up a considerable sum every year. In the hand of a skilful and scientific farmer a fortune might be realized on such a soil in a few years, by keeping up the fertility, instead of reducing it by excessive cropping of the land broken up from pasture: but especially by introducing improved breeds of cattle, and grazing them to advantage.

Not far from Roulers, at Newkerken, there is a small farm of about sixty acres, occupied by a Mr. Verpoort, which is worth noticing. The soil is a good sound grey loam of a moderate quality, the subsoil being retentive; the fields are divided by ditches four feet wide and three deep. Some trees and underwood are planted along some of the ditches, but not everywhere. There are no raised banks; the earth of the ditches having been spread over the land. The fields are all small, not exceeding three or four acres each, and mostly of an oblong shape. There was no water in the ditches when we saw it; but it is probable that in winter they are necessary to keep the land dry, as the country is so flat, that the water must be a long time in running off. The principal produce on this land is wheat, of which there are eighteen or twenty acres every year. The wheat this year (1837) was sown on land which the year before had been cropped as follows: two acres in beans, four clover, two potatoes, three colza, three flax, and four fallow—eighteen acres in all. Mr. Verpoort thinks that it might be advantageous to have more fallow, as the land is very apt

to be overrun with weeds, in spite of every precaution, and a fallow now and then is unavoidable. The other crops besides wheat were distributed as follows: three acres in rye and turnips, four oats, five flax, three colza, four and a half clover after flax, two beans, three potatoes, half an acre beet-root, five fallow, ten grass, half of which was pastured, and half mown. These ten acres lie along a low rivulet, and are flooded in winter. What makes this farm worthy of notice is the great proportion of wheat sown, and the variety of other produce, which return at a much longer interval, clover only every nine or ten years.

The whole of the work of this farm is done with two horses. There are thirteen fine cows, four heifers, two or three calves, one colt, and five or six hogs; and all these animals seem well fed. Except a few grains from the brewers, and some linseed-cakes, no food is purchased for the cattle, but the farm supplies all that is required. Mr. Verpoort used to breed horses and sell them to English dealers, who came round to the different farms, and bought three-year-old colts at a fair price; but none of them had been there for some time, at which he was disappointed, having a very promising colt eighteen months old, very large and fat, which he thought would be much admired. This colt had been brought up in the stable, like a fatting calf, without much exercise. His feet were flat and wide; and, from good feeding, he was large and heavy. He might at one time have been admired as a heavy dray-horse, but he was evidently very unfit for muscular action; and, although as well shaped as most Flemish horses, he was not likely ever to become very useful.

The cows on this farm were milked three times a-day for three months after calving, and only twice afterwards. They were fed in summer with clover cut for them and brought into the stalls. Occasionally they were let out into the pasture, but only for a few hours at a time, and never in the middle of the day, when the flies would teaze them. In winter they had their brassin, made of turnips and potatoes cut in pieces, and chopped straw, boiled together in a copper, and some linseed-cake added to this. Sometimes beans were soaked in water for twenty-four hours, and then mixed with the brassin. The roots were cut by a machine something like our turnip-cutters, but not so perfect. This is the only farm where we have seen a machine, as the spade is the usual instrument with which roots are cut. The chaff-cutter is exactly like our common chaff-box, where the work is done by the hand; and, except where horse-power can be applied, or the chaff-cutter can be attached to a mill, the hand-box is, perhaps, the instrument which will cut most chaff in a given time by mere manual labour. The cows are of the Dutch breed, and apparently very good milkers. Mr. Verpoort fattens calves a twelvemonth old, and thinks it more advantageous than if he kept them longer. This young beef is probably more readily disposed of in Flanders than it would be in England. All the labourers on this farm are fed in the house. The women have fivepence and the men eightpence a-day for wages, which makes the food to be reckoned at only threepence per head per day. A labourer obliged to find his own food could scarcely provide himself at so cheap a rate; but the farmer, who has everything from his own farm, finds that it is more economical to feed the labourers, even at that low rate. They have for breakfast bread and potatoes, with *tea*, as it is called, but it is a very weak infusion of that herb, and may be better called hot water with milk in it. For dinner they have a soup of butter-milk and bread boiled in it; after that they have potatoes and a bit of salt pork. For supper skimmed milk or buttermilk and potatoes.

The hogs are kept in separate dark styes, and fed on beans and the

remnant of the brassin. They are six months or more in fatting, and then not remarkably fat.

The whole farm is in very good condition and clean. The beans are sown in the furrows after the plough: the produce per acre, on an average, is four quarters of wheat, seven of oats, four of beans. All the roots are consumed on the farm. The land does not suit barley so well as wheat. The clover is usually sown amongst the wheat in spring. Flax is sown after oats, and colza after rye and turnips, which two last always come after wheat. This seems to be the most universal practice all over Flanders.

No sheep are kept on this farm; but a neighbouring farmer, who has eighty acres, keeps one hundred sheep, which he fattens, not by pasturing them, but by feeding in the stable like oxen. They have clover cut for them, and sometimes partake of the brassin. They get fat, but whether the flesh is well tasted when they are killed, is more than we can say; the principal object is profit, of which the dung forms an important item.

On another farm situated near Grammont, the property of Mr. Spital, who is a great *amateur* and breeder of English blood-horses, we found the soil of a still stronger nature, but the cultivation very similar to the last. The name of the tenant is Van der Stude, a sensible and intelligent farmer, who seems to be well acquainted with the practice of the best farmers. He holds about one hundred and thirty acres of land, of which three-fourths are arable and one-fourth pasture. A third of his arable land, or about thirty acres, is in wheat, ten rye, fourteen oats, fourteen clover, ten flax, twelve colza, three beans, three barley, and six in potatoes. There is no fallow, yet the land is clean. It seems not so wet as the last, and this may account for the fallows not being so necessary. He sows turnips after rye or colza. The colza plants are raised on the land which has had clover upon it, with one ploughing. The flax is sown in March, on clover ley also, with only one shallow ploughing, which is given before winter; but the land is repeatedly harrowed before the flax is sown. Everything which is grown on the farm, except wheat, flax, and rape-seed or colza, is consumed upon it. His urine-cistern is twenty feet square, and seven feet deep, but he says that it is much too small. There is a smaller cistern under the dung in the yard, from which the drainings are occasionally pumped up, and spread over the dung to accelerate its decomposition. The produce of the land is from four to five quarters of wheat per acre; the same of colza; but this last is worth one-fourth more than the wheat. The flax is sold on the ground at about sixteen pounds an acre, the farmer feeding the labourers who pull it;—this is a lower produce than where the land is differently prepared for this crop.

The stock consists of seventeen cows, five calves, and a few heifers, nine cart-horses, and three colts. The labourers are fed and paid exactly as in the last farm. A few hops are grown on about half an acre.

Near Alost we met with one of the smallest farms, which will maintain a family without other work: it was barely five acres. The house was much larger than such an occupation warranted; but it was an old farm-house, and the land had been divided into small holdings, leaving only five acres to go with the house. There was a small orchard of about a quarter of an acre, in which there were some thriving apple and plum-trees. The grass under these was good; and the only cow which the man had was led by the wife to graze there for a short time every day, apparently more to give her exercise, than for the food she could pick up. The grass seemed to have been cut for her in another part. This cow had cost eight pounds, and the man regretted that he had not had the means to purchase a second, as he could have maintained two very well. Half of the land

was in wheat, the other half in clover, flax, and potatoes; so that the clover did not recur sooner than in six years; the flax and potatoes in nine. As soon as the wheat was cut, he began to hack the stubble about four inches deep with the heavy hoe, and as fast as he got a piece done, it was sown with turnips, after having some of the contents of the urine-tank poured over it; for, small as the farm was, it had its reservoir for this precious manure. Thus a considerable portion of the wheat stubble was soon covered with young turnips of a quick-growing sort, which, if sown in the beginning or middle of August, were fit to be pulled in November and December, and stored in the cellar for winter use. There was a small patch of cameline, which was sown less for the seed than for the stem, of which he made brooms in his leisure hours in winter. But these hours could be but few, and only when snow covered the ground, and prevented him from digging and trenching, which was a constant operation; for the whole five acres had to be dug in the course of the year, and as much of it as possible trenched; the soil being a stiff loam of a good depth, which was much improved by trenching and stirring. The milk and potatoes fed the family, with the addition of a little salt pork; for a pig was fed on the refuse of the food given to the cow, and a very little corn, and consequently was not overburdened with fat. Most of the wheat and all the flax were sold, and more than paid the rent, which was not high—about 10*l*. a-year without any rates, tithes, or taxes. Incessant labour kept the man in good health, and his wife was not idle. They had two or three young children, one at the breast: but, except the wish for another cow, there seemed no great dissatisfaction with their lot, nor any great fears for the future. They had no parish-fund to fall back upon, not even a union workhouse; but, had they come to want by unforeseen accidents, they would have found the hand of private charity stretched out to help them.

We have before alluded to a farm of which the occupier kept ewes for the sake of their lambs, which he alone in the neighbourhood fatted for the butchers. His name is De Keyart, and his farm is situated at a little distance from the neat and flourishing village of Hamme. It consists of sixty-five acres, of which five are meadow, near a little rivulet. The ewes are kept as another farmer would keep cows. He considers the keep of one hundred sheep as equal to that of fifteen cows. He has, however, five cows also; and three horses do the work of his farm. His rent is about thirty shillings an-acre—a considerable rent, but small in proportion to the price of land, which here sells at an extravagant rate, not paying two per cent. for the outlay. Hamme is in the Waes country, where the cultivation is carried to the greatest perfection. One-sixth part of Mr. Keyart's farm is trenched two spits deep every year, which costs him 30 francs—about 1*l*. 5*s*. per acre. This shows that the land is light, and the trenchers expert, to be able to do it at that price. The first crop on the trenched ground is potatoes, after the land has had twenty tons per acre of good yard dung spread over it. This is ploughed in four inches deep. After a fortnight an equal quantity of dung is put on, and this is ploughed in seven or eight inches. It must be observed that in ploughing the ground is turned completely over, so that the dung lies under the furrow-slice. The second ploughing does not bring the dung first laid on the surface again; but the point of the share, going four inches under it, lifts it up enclosed in two layers of earth; that which had been above the first dung is turned down upon the last portion, and the four inches last raised are turned to the surface, so that there are two distinct strata of dung, if we may so express it, one four inches under the surface, and the other eight. The advantage of this method must be obvious; and the ploughmen who can execute it

should not be despised. Potatoes are planted on a part of this ground, and hemp sown on the remainder. The potatoes are put into holes made with a blunt dibble, and it will be perceived that, if they are put in six inches deep, they are placed between two layers of dung, and cannot fail to grow readily in such a rich and mellow bed. When the potatoes are fairly up out of the ground, the earth is stirred and raised around the stems, and liquid manure is poured on the little heaps thus made. It is not surprising that with so much manure a great crop should be produced: but this manure is not all put in for the sake of the potatoes only, but for the flax, which is to follow, for which the dung should be well incorporated with the earth, and the land very clean. For the flax rape-cakes dissolved in urine, or what is preferred—*vidanges*, form the chief manure. Carrots are sown soon after the linseed, if not at the same time. In weeding the flax great care is taken not to pull up the young carrots; when the flax is pulled the carrots are already very forward, and, by the help of the urine-cart, soon swell to a good size. After the flax and carrots the land is manured with fifteen tons of dung, which is ploughed in, and wheat sown in October. The next crop after wheat is, as usual, rye and turnips, with six tons of dung. Then oats without dung; and, after them, buckwheat also without manure. The course then begins again with a fresh trenching. This is the usual course in the sandy loam of the Waes country. But what distinguished Mr. De Keyart's farming is his flock of ewes. Of these he has 100, who are carefully fed in the yard in summer and under cover in winter. All their food is brought to them, and as the lambs are the principal object, the ewes are well supplied with roots and corn in winter. The old crones are fatted off regularly. The manure is collected carefully: what can be washed into the tank goes there; the more solid part is mixed with earth before it is put on the land. His crops are as those of his neighbours, viz.:—wheat about four to five quarters an acre; flax worth 20*l.* an acre; hemp 12*l.* In 1837 there were on the farm twenty acres of wheat, eight of flax (part with carrots and part with clover), three of hemp, four of clover, four of oats, two of buckwheat, fifteen of rye and turnips, two of potatoes (fifty-eight acres in all). The remainder of the sixty-five acres is pasture and homestead. The wheat is thrashed with the instrument described in page 19, and the chaff beat off is boiled in the brassin. Here we observed some small stacks of wheat neatly thatched, which might contain eight or ten loads of straw in each. The making and thatching of these is here a separate trade.

In the neighbourhood of Tamise there are many small farms chiefly cultivated by the spade, which are perfect models of this species of husbandry. The farm of a man named Everart may be taken as an example. He has eight acres of land, and keeps three cows. The whole is cultivated by himself, with the help of a labourer during three months in the year, who is chiefly employed in trenching and digging. The manure is carried on the land in wheelbarrows. The land is much poorer than in the farm we noticed near Alost. The first crops after trenching are buckwheat and potatoes—the latter with all the manure that can be spared—as many as sixty tons an acre are frequently put on. By this means the produce will be one hundred and twenty sacks, each of 200 lbs. weight, or nearly twelve tons, which is a very large crop on such a soil. After potatoes he sows wheat, then rye and turnips, then flax and clover, wheat, rye, and turnips: this is the regular course, which is only varied by carrots being sown in part of the flax, so that the clover may not recur too soon on the same ground. The cows are kept in stalls with their heads completely separated from each other: each cow has her own trough, and cannot interfere with

her neighbour. The partition goes back as far as behind the shoulders of the cow: when she lies down she cannot see any of the others. The food is given to them from a narrow chamber before them, in which are the troughs for the brassin, so that they may literally be said to feed like pigs. They are cleaned and curried like horses.

The habitation is neat, only one story high, containing a kitchen and two chambers, with a small garret over these. There is a small barn, cow-house for three cows, with a calf-pen. There is a place where a horse might be kept; but a horse would only be profitable if there were more land; at present his keep can be saved. The urine-tank with the privy over it is an indispensable part of every farm-yard, however small. The wheelbarrows, which are used instead of carts, have a large wheel, and the frame is light. They are calculated to carry dung and sheaves of corn. The liquid manure is carried to the field in a tub, sometimes by means of a pole between two men, or a man and a woman, sometimes on the wheelbarrow. It is poured out by means of a bowl, with a long handle, and which can take up liquid and semi-liquid substances equally well. There is an appearance of comfort in these little farms which is very pleasing. Hard work, instead of being here thought an evil or a hardship, is thought essential to the health and comfort of the individual. The children are brought up in industry. It is interwoven with all their associations; and when the young men marry, they find wives who are brought up in the same manner, and are useful helpmates to them. The great ambition of the small Flemish farmer is first of all to be able to set up his children, by giving them what is indispensable in taking a small farm. If he has been very successful, and at the same time very frugal, he will hoard his savings till he can buy a few acres of land of his own. If he can build a house, he then has arrived at the utmost point that the most sanguine man can look forward to. There are many small proprietors who have risen slowly by the labour of their own hands; and their habitations show, by their extreme neatness and the care taken of everything about them, that they feel a pride in enjoying the just reward of honest industry.

CONCLUSION.

From the general outline of Flemish husbandry which is given in the foregoing pages, and from the examples which we have added, the general principles which pervade the whole system are easily discovered. The garden has evidently been the model for the operations of the farm. The spade has originally been the chief instrument of cultivation; and when a greater extent of farms necessarily introduced the plough, the favourite spade was not entirely laid aside. A Flemish farm of forty or fifty acres must still be looked upon as an enlarged garden; and if a comparison is instituted with the cultivation of land in England, we can only compare the Flemish husbandry, as far as tillage is concerned, with those large unenclosed gardens which are found in the neighbourhood of London; where the common vegetables are raised which supply the markets; where green crops are cut early for horses and cows kept in London; and where the soil is continually enriched by the manure, which is brought every time a cart returns from having carried out the produce. In these grounds the system is similar to the Flemish—deep digging or trenching, abundant manuring, and a rapid succession of crops. But there is one part of the Flemish system in which even the market-gardeners are inferior to the

Flemish farmers. This is the collection and application of liquid manures. In England stable-dung laid in large heaps and allowed to heat to a considerable degree, which is promoted by frequent turning and mixing the different parts together, is the principal manure of the market-gardener. It is put on the land in great abundance, and often without much attention to the state it is in, when the plough or the spade turns it into the ground. But the value of rich manure in a liquid state is not appreciated. The emptyings of privies and the refuse of slaughter-houses, which are carried in a semi-liquid state in tumbrils made on purpose, are mixed up with the stable-dung to accelerate its decomposition: but there is no tank or pit in which it can be kept separate, or diluted to the degree required to act directly on the roots of the plants, without injuring them by being too concentrated. This is the great secret of the Flemings, by which they have converted poor sands into rich mould, and produced in the lightest soil crops of wheat as fine and heavy as we do in our best clay-loams. The total ignorance or disregard of the power of urine on vegetation cannot be better shown than by the fact, that a large cow-keeper, near London, having built a reservoir for the urine of several hundred cows, thinking to make some profit by the sale of it, found so little demand for it, at a very low price, or even for nothing, that he destroyed the tank, and let the urine run into the common sewers, to add to the variety of rich impurities which daily flow into the Thames. A gentleman from Flanders, to whom this was mentioned, asserted that, in his country, there would have been many applications to contract for all the urine, at the rate of 2*l.* per cow per annum—a sum which would have amply repaid the cow-keeper for the expense of his tank, and put a large annual sum into his pocket. It is not that gardeners are not aware that urine is a rich manure; but they want experience in the management and application of it, and every Flemish farmer could teach him this, if he would: and a few experiments with common attention would enable any intelligent man to find it out himself.

It would be of little use to observe the varions methods of cultivation in other countries, if we did not endeavour to apply them where it may be done to advantage. The practices of gardeners are always a good example to farmers; and wherever they can be introduced on a great scale they are always found bighly beneficial; so the methods adopted by the small farmers and by those who cultivate by the spade in Flanders, might be introduced on a much larger scale on light sands in England. Instruments may be invented by which the ground may be tilled as effectually as by digging, and much more rapidly. The subsoil plough, lately introduced, is an approach to a rapid method of trenching. The gradually mixing the subsoil with the surface is readily accomplished by its use. The manuring with liquid manure may be effected on a hundred acres as easily as on twenty, provided tbere be a sufficient number of beasts kept stalled to produce it. If one tank could not contain all the liquid, it is better to have several in different parts of the farm. There is nothing to prevent a man of capital from multiplying his farms; and if be applies the same quantity of labour, and keeps the same number of cows, in proportion to the number of his acres of land, he may have the same results. It would startle a farmer of four hundred acres of arable land if he were told, that he should constantly feed one hundred head of cattle; and yet this would not be too great a proportion, if the Flemish system were strictly followed. It is probable that in a large farm, by means of a division of labour, the whole work might be done at a comparatively smaller expense. There might be buildings in different parts of the farm, in which the cattle might be fed, so as to avoid carrying the green food, or the manure, to a great distance. By

having several trusty servants to superintend the management of the different departments of the farm, great regularity might be introduced; and a system of checks might be contrived, by which the occupier of an extensive farm might have all his work done as regularly and effectually, as if he had only a few acres to manage. A large farm requires a large capital, and unless there be very accurate accounts, nut only of money paid and received, but of work done, of fodder consumed, and of the distribution of the labour of men and horses, so as immediately to detect any extravagance or error, and at all times to show the profit or loss, there can be no inducement to apply capital to the cultivation of land. The Flemish farmer is contented to live and bring up his family. The proprietor is satisfied if he gets some return, either in rent or produce, adequate to the value of his estate: but the speculator who embarks his capital expects to have a fair interest, which will cover his outlay and his risks. Agriculture has not often presented advantages sufficiently tempting to induce mere speculators to embark in it: yet considerable fortunes have at times been made by improving land, and no doubt may be made again. The failures have been owing to want of prudence, as well as to the want of a practical knowledge of agriculture. A man who would embark his capital in farming should have served an apprenticeship: he should have managed a small farm before he attempts a large one. But if he has acquired experience and expects no miracles, he will find that, by attention, perseverance, and skill, he may not only gain a decent livelihood by cultivating the soil, but that he may invest a capital in agriculture, so as to pay him a very handsome interest without much risk.

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CHAPTER VIII.

PLANTING.

The subject of planting may, with propriety, be divided into three parts: useful or forest-tree planting, ornamental or garden planting, and orchard or fruit-tree planting. Each of these divisions of the subject, from its importance and interest, in a national point of view, as well as to individuals, seems to demand a distinct treatise.

The first of these, forest-tree planting, is proposed for the subject of the following pages; and the details of the theory and practice of the art discussed under the following heads:

I. Of some of the advantages resulting from judicious planting.

II. Of the structure of trees; and of the natural agents which influence and govern the growth of the plant from the period of germination to its full maturity. Of the seeds of forest-trees; and of the processes of vegetation.

III. Of the different modes of rearing forest-trees:—by sowing the seeds on the spot where they are to remain for timber; of sowing the seeds on nursery beds, and afterwards transplanting the young plants to their timber sites; by preserving and training proper shoots or suckers, produced by coppice roots or stools. Comparative advantages and disadvantages of these different modes. Of simple and of mixed plantations.

IV. Of the soils and sites most profitably employed in the growth of timber. Intimate nature of the different soils peculiarly adapted for the growth of particular species of forest trees.

V. Of the most approved modes of preparing different soils for the reception of the plants: fencing, draining, ploughing, trenching. Of the formation of rides or carriage-ways into the interior of plantations. Of the best mode of covering these with herbage.

VI. Of the culture of plantations: soil, pruning, thinning. Remedies for accidental injuries, and natural diseases of forest-trees. Seasons for felling trees. Of the tannin in the bark of different species of trees.

VII. Of the progressive increase of the size or produce of wood in different species of trees. Of the mode of valuing plantations: present value; prospective value. Of the products of plantations. Of some individual trees which have attained to great perfection. Of the terms used to denote certain products of plantations.

VIII. An enumeration of the different species: those of large growth, those of under growth for copse wood, ornament, or shelter. The generic botanical characters. Their natural soils; mode of propagation; and the uses to which their timber is more generally applied.

Chapter I.

Of some of the Advantages resulting from judicious Planting.

Judicious planting and the skilful culture of plantations combine national and private interests in an eminent degree; for, besides the real or intrinsic value of the timber or ostensible crop, with other produce of woods, available for the arts and comforts of life, judicious forest-tree planting improves the general climate of the neighbourhood, the staple of the soil, as regards the gradual accumulation of vegetable matter, affords shelter to live stock, promotes the growth of pasture and of corn crops, beautifies the landscape, and thus greatly and permanently increases the value of the fee simple of the estate and adjoining lands.

If we turn to those soils emphatically termed wastes—exposed, elevated lands, moors, bogs, and sterile sands—composing so large a portion of the British empire, and naturally clothed by the lowest and least valuable products of the vegetable kingdom, the inferior grasses, mosses, rushes, sedges, ferns, and heaths—we find that upon them the more valuable domestic animals cannot exist. If we consider the reason why they are so barren, waste, and unproductive, when compared with other lands not more favoured by nature, and under similar circumstances of latitude and elevation, the cause will, in many instances, be found in the want of the shelter and shade of trees, and of the ameliurating influence which plantations exercise on ungenial local climates.

The essential, permanent pasture grasses cannot be established on naked exposed situations; but when assisted by the shelter of forest-trees they become permanent and productive. Plantations supply us with with fuel, with materials for fencing, enclosing, building; corn crops, soiling plants, and root crops are obtained in succession under their genial protection. Many thousands of acres now unprofitable to the owners and to the community, might, by judicious planting, be reclaimed, and rendered highly productive; and it may be safely affirmed, that there is hardly a spot of waste land in the kingdom so barren, which by the exercise of skill in planting, and selection of proper species of forest-trees adapted to the soil and exposure, might not be covered with profitable plantations.

Numerous instances might be cited from different parts of the kingdom where exposed and sterile lands have, by planting, been made capable of producing valuable arable crops and the best pasture grasses, and of rearing and fattening stock of improved breeds. This, in effect, is adding to the territorial extent of a country, to its wealth and strength, by conquest over the natural defects of local climate, soil, and exposure.

Chapter II.

Of the Structure of Trees, and of the Natural Agents which influence and govern the growth of the Plants, from the period of Germination until the Trees arrive at full maturity.

Plants being living organized bodies, a just knowledge of the functions of their vital organs, and of the principal natural agents which influence their progress of growth to maturity, will be found a useful, if not an indispensable assistant to guide the practical planter in rearing trees in the most

judicious and successful manner. This part of the subject properly belongs to vegetable physiology; and as the limits of an essay do not allow of entering into minute details, we shall here only notice those leading features of the structure of trees, and those functions of their vital organs, which more immediately influence the practical operations of the planter. In considering the progress of vegetable life, physiologists have distinguished six principal parts of a tree: the *root*, the *stem*, the *branches*, the *leaves*, the *flowers*, and the *fruit* or *seed*.

The varieties of the root of forest-trees are characterised by the namea of tap root, fibrous root, and creeping root, these may be considered rather as indicating particular states of the same organ at different stages of growth than as permanent or specific distinctions *.

The tap root is that which first appears on the vegetation of a healthy seed, and penetrates perpendicularly into the soil. From it issue numeroua minute radicles; and as the proper leaves are developed, lateral roots or fibres are formed and sent out from the sides of the tap root, particularly at the point of junction situated between the radicle and stem.

As the plant advances in age the distinction of the tap root is lost, either by decay or by its taking a horizontal direction in common with the general mass of roots, and from which in a few years it is not to be distinguished. Other leading roots are frequently formed from the first delicate lateral fibres, which pervade the tap root, and sometimes from its extremity when it happens to divide into parts, which always takes place when the extremity comes in contact with a richer or more genial soil, or, on the contrary extreme when it meets with obstructions in its first or early descent from whatever cause, rocks, gravel, &c., or by injury from insects: if the tap root be taken from the seed leaves before the plumula appears, or before the development of the proper leaves, the young seedling dies; and, again, should the tap root be deprived of the seed leaves before the production and expansion of the proper leaves, no farther reproduction or growth takes place. The uses of the tap root, it will readily be perceived from these facts, are of great importance to the plant in its first stages of growth, and may be compared to the equally essential and important uses of the seminal leaves, at the same period; but its subsequent destruction does not, as it has been supposed, influence injuriously the ultimate produce or value of the tree.

Two or any equal number of trees, for instance, of the same age, of the like constitution, and reared on a soil of the same nature, the one from seed on the spot, the other being transplanted from a nursery bed, without, or with a portion only of its tap-root, will give results which prove that trees, when transplanted at a certain age and size, and in all other respects of culture under the same circumstances, produce timber in quantity and in quality equal, if not superior to untransplanted seedlings. Whether, therefore, to raise forest-trees from seed on the spot where they are to

* In practical planting, as well as in practical botany, the root is considered to be that part of a plant which is hid underground, and the varieties of it are characterized according to the shape and mode of growth, as bulbous, tuberous, fibrous, or creeping; these again are susceptible of subdivision as they vary from the type. In physiology, however, the fibres or radicles are alone recognised as the roots, as it is they only which take up the food of the plant supplied by the soil.

The tuber of the turnip, potato, &c. and the bulb of the hyacinth, &c. are properly reservoirs in which to deposit the food of the plant until wanted in season for the production of leaves, flowers, and fruit, or seed. Indeed, bulbs and tubers may be considered the plant itself in certain stages of its progress to maturity. A deciduous forest-tree in winter, when without its leaves, flowers, and seed, may be compared to a bulb or tuber, when destitute at the same time of these parts of a plant. Roots, in general, are also distinguished in practice as to duration, being annual, biennial, and perennial.

produce timber, or in nursery beds, and afterwards transplant them, is a question of mere expediency.

Where seeds of the kinds of forest-trees desired can be had at little cost; where the soil is friable, is in a perfectly clean state, and consequently adapted to the plough culture; where such animals as are destructive of seeds and young plants, as mice, rooks, and game, particularly hares and rabbits, are not likely to be greatly destructive; and where the cost of labour is not comparatively high, then sowing the seeds of forest trees on their timber sites, may be the best practice and be adopted with success. But where, on the contrary, these obstructions exist or are probable, transplanting select healthy trees from nursery beds, though the plants be deprived of their tap roots, will be found more economical in the first outlay, and in the subsequent cost of culture; and the most profitable, as affording a quicker return of profit in prunings and thinnings, and will produce timber in a less number of years from the time of occupying the land for that purpose.

The fibrous root is that which is most common to forest-trees. It consists of numerous divisions or bundles of fibres, furnished with minute spongeols, and nearly representing the divisions or ramifications of the large and smaller branches and buds of the tree.

The variety of creeping root is chiefly confined to those trees which have the roots running horizontally, as in some species of poplar, elm, &c.

The organization of the root is similar to that of the stem and branches, from the *pith* which forms the centre of the body to the *epidermis* which covers the bark. Each part may be traced in uninterrupted continuation, from the minutest radicle of the root to the extremity of the smallest branch or bud of a tree.

When a root of whatever kind is divided, its horizontal section exhibits three distinct parts, the *pith*, the *wood*, and the *bark;* and a transverse section of the *trunk* of the tree, or of a branch, exhibits exactly the same parts.

The *pith* forms the central circle of a *root*, *stem*, or branch: it is a cellular membraneous body of a silvery white colour. As the tree or root advances in age and the timber is perfected, the pith gradually loses its original spongy texture, the cells of which it is composed becoming more and more compressed until all appearance of it is lost in the wood, excepting that the concentric circle which it occupied appears whiter than the other annual layers. But although the pith thus disappears in the old, it still continues in progress with the young wood of the root, stem, or branches; and the periodical fibres or radicles of the former, and the buds or embryo branches of the latter, will on examination be found to originate from it. When a branch is pruned off close to a stem wherein, from age, the pith has disappeared for some distance above and altogether from below the origin of the amputated branch, no reproduction of shoots takes place in whatever season the pruning may be performed, but should a portion of the branch be left to the stem, from that buds and shoots will spring. It also happens that when a branch is pruned off close to a young healthy stem containing perfect and active pith, before or shortly after the completion of the midsummer growth, which usually takes place before the end of July, no reproduction of shoots follows the operation, but the efforts of the vital functions of the plant appear to be wholly directed to cover the wound with fresh bark. Should the pruning, however, be performed in spring before or shortly after the expansion of the leaves, or after their fall in autumn, a reproduction of buds and shoots ensues, and a slower progress in the formation of new bark is apparent.

The presence of leaves is essential to the growth of buds and branches, and consequently to that of the pith in these and in the roots; but the leaves are not otherwise necessary to the formation and growth of the fibres or radicles of the root, as these are produced in abundance when the plant or tree is leafless, and even during winter when the ground is covered with frost and snow, the reservoir of nourishment in the *pith* being probably sufficient for that purpose.

From these facts and others which might be brought forward, it is clear that the uses of the pith in the formation of buds in the branches of the tree, and of fibres or radicles in the root, and in the support of these during the first stages of growth, are analogous to the important functions of the seed leaves in the first stages of growth of the seedling plant. The pith of a radicle or fibre may readily be traced into that of the root, and the same is precisely the case in a branch with relation to the stem of the tree. The respective uses of these organs are only for the first and early stages of growth; and, after that, they may be lost without any apparent injury to the further progress of the parts in question: the cotyledons dry up and fall away as the healthy progress of the roots and leaves advances, and the pith disappears, or its identity is lost in the wood, as that part of the structure which surrounds it approximates to maturity. *

The *wood* stands next in order to the pith, it is formed of indurated vegetable fibre, and occupies the space between the pith and the bark; it constitutes the bulk and strength of the subject. The yearly growth or increase of the wood is defined by circular lines or concentric layers clear to common observation in a transverse section of any root, branch, or stem. The discriminating characters of the wood being more obvious in the stem, than in the root or rootlets, we shall consider it more particularly when mentioning the stem.

The *bark* covers the wood in every part of the tree, and is the most important organ of vegetable life, for the pith may be lessened, the wood may be partially or even wholly taken away, and, the leaves may be stripped off, and yet the tree may recover, but when deprived of its bark, the root, stem, or branch of a tree dies. It is therefore of the greatest importance to the practical planter, that the bark of the roots and of the exposed system of his plants should be preserved free from the slightest injury.

The bark when divided horizontally shews three distinct parts, the liber, or inner bark, which lies next to the wood; the cellular tissue, or parenchyma, which is distinguished in the bark of the exposed system of the plant by its fine green colour, but which is colourless in the bark of the root; and, lastly, the epidermis, or outer bark, which is the universal covering of every part of a tree.

* A scion grafted on a stock, and a bud separated from its parent shoot and inserted into the *bark* of another tree, may at first sight offer proofs going to invalidate the opinion of the important uses of the pith in the formation of buds and fibres; but before the scion and the bud are taken off, or are in a fit state for the purposes of budding and grafting, the pith of the parent stock has already performed its offices. The important experiments of Mr. Knight on this subject prove that the pith may be removed in part without effecting the general health of the tree, just as the cotyledons may be removed from the young plant after having established its root and stem, with a continuation of pith to originate new buds, or embryo branches and radicles. We often meet with roots, which from severe injuries by mutilation at an advanced age of the tree, or by the injurious effects of a damp ungenial soil at an earlier period of growth, have lost the entire substance of the pith and wood, and present the appearance of a hollow tube, have yet young fibres or radicles issuing from their sides and continued as in roots where the pith and wood is perfect; on examination, however, these young fibres may be traced through the bark into the hollow of the root, demonstrating the origin of the radicle from the pith.

On young shoots and stems the epidermis appears membraneous, or as a thin transparent membrane without vessels; but late researches, aided by powerful glasses, have shewn that it is partially furnished with minute retiform vessels, particularly in the leaves.

When casually displaced off young shoots it is reproduced with little apparent injury to the part, unless it happen on the annual parts of the tree, as the leaves and flowers. In old stems and branches the epidermis often attains to considerable thickness, becoming hard, rough, or granulated, as seen in the trunk of elm, oak, and most kinds of forest-trees, and in the trunk of the apricot, pear, &c., among fruit-trees. When in this latter state, the epidermis may be removed without injury, and, in some instances, it has been cleared away from these fruit trees with evident advantage to their general health and fertility *.

The parenchyma is composed of hexagonal cells, containing juice, which in the stems and branches is of a green colour, even when covered by a thick indurated epidermis; but in the root, as before alluded to, the juice of the parenchyma is colourless.

The inner bark consists of cortical layers, constituted of longitudinal fibres or vessels, which are supposed to return the sap from the leaves after their undergoing certain changes by the action of solar light, heat, and air. The medullary rays which pass from the pith to the cellular textures of the inner bark and parenchyma in a horizontal direction, appear to be the medium of a lateral intercommunication of sap and air throughout the entire structure of the tree†.

The green colour of the parenchyma depends on the exposure of its epidermis to light and air; for when a portion of the stem of a tree is excluded from light, as is sometimes done in planting when the tree is placed deeper in the soil than it stood before transplanting, the green colour is destroyed in that part of it which is covered with the soil, and which in course of time assumes the colour of the root; and, if much moisture exists in the soil and the tree be not young, the bark so covered decays, and the tree dies. Should the soil be dry, however, and the plant

* In 1813 the following trial was made to ascertain the effects of removing the rough, hardened epidermis from the trunk and limbs of a very large and aged Crassane pear-tree. The tree was trained horizontally on a west wall, the branches extended twenty feet on each side of the large trunk in the most perfect order. The stem was cleared of the *rough* epidermis entirely, and the branches on one side also were treated in like manner. The branches which extended on the other side of the stem, had only every alternate branch stripped of the rough, hardened epidermis. Previously to this, the tree had for many years ceased to bear fruit, except occasionally one or two at the extremities of the upper branches. The first season after the above operation, the foliage assumed a more healthy appearance on the decorticated branches, and in the course of the second year many fruit buds were formed, which afterwards produced fruit of very good quality. The branches which were suffered to remain with their hardened epidermis, continued barren. Adjoining to this tree was another of the same species, apparently of the like age and of nearly the same dimensions. In this instance every second branch was pruned off near to the stem, and young grafts of the crassane, colmar, brown beurrie, and St. Germain, united to stumps of those branches respectively. These grafts all succeeded so well that in four years from the period of grafting they had nearly attained to the length of the old branches, and produced full crops of fruit of a very superior quality. The old branches, which had purposely been left, remained in the same barren state as before. The branches produced from the grafts were superior at the end of the fifth year, in regard to health and produce, to the decorticated branches; and these last were in a like proportion superior to those branches which were left untouched. These facts go to prove clearly that the thickening and hardening of the epidermis has a very considerable influence on the health and fertility of a tree.

† It is contrary to every known law of the vital power, to suppose that any part of the structure of a living organized body can resist decomposition or decay, if it be cut off from a reciprocal communication with the circulating vital juices.

young, the bark in question is gradually converted into root-bark; during this conversion of the stem-bark to that of the root, the plant advances but little, if any, in growth, but exhibits an unhealthy appearance by the paleness of its leaves, and the weak growth of shoots. The same effects are in a great degree observable from the opposite error, of planting too shallow, which is when a portion of the root nearest to the stem is left above the ground. This exposed portion of the root-bark in time gains the green colour in its parenchyma; and although no portion of it is ever found to decay, as in the former instance, yet, for a time, the plant makes but little progress in the growth of wood: if a fruit tree, the effect appears to be to increase the formation of fruit buds, and to stimulate the functions of the tree to bear fruit. It may not be devoid of interest to remark here, that this is a more efficacious mode of inducing a free growing though barren fruit-tree to bear fruit, than any of those recommended for that purpose, such as *ringing*, or placing an iron ring round a branch to prevent the annual increase of bark on the space occupied by the ring, cutting the bark in the manner of a circular incision of a branch, dividing the roots, and by reversing the natural direction of the branches. It may be unnecessary to add, that the above facts point out the importance of planting every tree not deeper in the ground, nor farther out of the surface, than the root occupied in the soil previous to transplantation; most essentially when the produce of wood or of timber is the primary object desired.

The *stem*, *trunk*, or *bole*, constitutes the principal body of a forest-tree. It is the medium of communication between the root and the branches, leaves, flowers, and fruit or seed. By the exercise of this function it obtains its yearly increase of substance, marked by the white circular lines apparent on the surface of a transverse section of the stem of every species of forest-tree. By counting the number of these circles the age of the tree may with certainty be determined.

It was before observed that the structure of the root was similar to that of the organization of the stem and branches; but a more particular notice of the constitution of the wood was referred to this place.

A close examination * of a horizontal section of the wood of a trunk or branch of a tree, will exhibit two very distinct appearances.

1st. A series of white and shining laminæ, which radiate from the pith to the bark (*fig. b*, 1)†. These generally straight, or sometimes interrupted, lines are termed the silver grain or medullary rays of the wood. These vary as to size and arrangement, termed primary or secondary rays, continued in one straight line from the pith to the bark, or interrupted and broken in the course of their direction, according to the species of tree which affords the wood in question. They appear to be composed of cellular tissue, and to originate from the pith, or, in a word, are a linear lateral extension of that organ. These medullary rays are elastic and contractile, as is evident to every one who has observed the effects of the extremes of dry and of moist weather on the section of a felled tree.

2d. A series of concentric layers, or circles, termed the spurious grain. These consist of tubular vessels of smaller or larger diameters, arranged in lines or groups varying according to the genus and species of the tree to which the wood belongs.

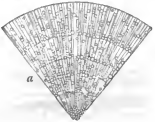
* With a common or four-power microscope. A thin slice of the substance is, perhaps, the most convenient for examining. When placed under a high magnifying power the beauty, order, and arrangement of the tubular and cellular texture will reward the observer.

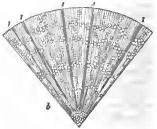
† These should be examined with a magnifying glass, for the texture of the different woods exhibited will thereby be more satisfactorily compared with the descriptions which accompany them.

An examination of many different kinds of wood proves that these characters of distinction are constant, and, therefore, afford a certain means of distinguishing the wood or timber of one species of tree from that of another.

The following discriminating characters of the woods of the principal timber trees will be found constant:—

The wood of the elm (*fig. a*) is distinguished by having the medullary rays, or silver grain, equal, and not crowded. The concentric layers are composed of a series of cells of nearly unequal diameter, arranged in an almost simple curved line. The spaces between the layers are furnished with cells of a smaller diameter, and rather thinly scattered over the surface.

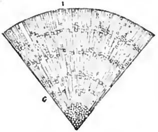


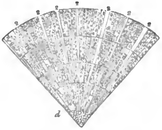


The oak (*fig. b*) has two series of medullary rays; the primary ones are large and strongly marked, distant from each other, and are uninterrupted in their course from the pith to the bark (*fig. b*, 1). The secondary rays are numerous between the primary, but not crowded.

The concentric layers, or circles, are distinguished by the arrangement of the cells. They are grouped in somewhat triangular masses, forming a wavy circular outline. The structure of the concentric layers or annual rings, distinguish at once with certainty the wood of the oak from that of the chestnut, with which it has often been confounded.

The wood of the ash (c) has the places of those rays so prominent on the wood of the oak, supplied by twin rays (1) placed in wide intervals over the surface, and between these double rays are smaller ones, placed in regular order. In the narrow spaces between the individuals which constitute the twin rays are wanting those apparent remains of the cellular texture which are so remarkable in the spaces between the single rays.



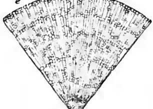


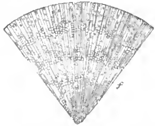
The wood of the beech (*d*) has the primary rays (2) dispersed pretty regularly over the surface of a horizontal section of the wood; the secondary rays are not continuous from the pith to the bark, but interrupted,

and exhibit a numerous series of fragments of rays, filling up the spaces between the primary ones, obvious to the naked eye, and rendering the silver grain, as it is called, of the beech very distinct from any other kind of wood.

The wood of the Spanish or sweet chestnut (*e*) has often been confounded with that of the oak; but its characters of distinction are very obvious. It agrees with the oak in having the secondary rays equally disposed, almost straight, and, though close to each other, yet not crowded as in the elm and beech; it differs, in the primary rays being scarcely to be distinguished from the secondary, whilst in the oak these are prominent and obvious to the naked eye on the slightest inspection. The concentric layers are regularly curved, whilst in the oak they are strikingly waved. The mouths of the tubular vessels, which constitute so obvious a part of these annual rings, or layers, are disposed in triangular masses in the oak; on the contrary, in the chestnut they are in regular order.

e

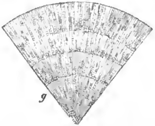




f

The hornbeam (*f*) has the rays of the wood nearly equal, but may readily be distinguished from that of the beech, to which it bears the greatest resemblance, by the simple arrangement of the tubular structure accompanying the concentric layers, which in the hornbeam are distant and oval shaped, the narrow sides pointing to the pith and to the bark; in the beech they are circular shaped, more numerous, and equal sized.

The birch (*g*) has all the medullary rays nearly equal, arranged closely, and having the concentric circles minute, but marked with a row of equal cells.



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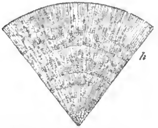
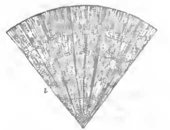
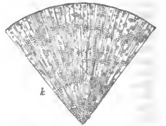


h

The horse chestnut (*h*) has all the rays very minute, few of them apparently continuous, but interrupted, and in substance varying in breadth. The cells are numerous and minute.

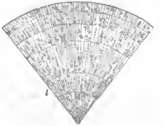
Alder (*i*) has the wood with large primary rays, thinly arranged, but in nearly regular order; the secondary rays are slender, numerous, and interrupted. The cells of the concentric layers are nearly regular. The spaces between the rays are crowded with cells.

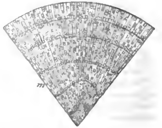




Oriental plane (*k*) has the primary rays regular but closely arranged; they are somewhat wavy; the cellular texture of the concentric layers but slightly marked.

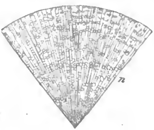
The sycamore (*l*) in texture approximates to the plane: still, however, it is very distinct in its straight lined rays, which are very minute or slender. The cellular texture is composed of such minute cells as scarcely to be perceptible under a four power microscope; these cells are, however, very numerous.

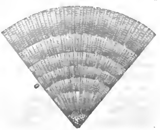




The poplar (*m*) has the wood composed of rays so slender as not to be obvious to the naked eye. The concentric layers are composed of exceedingly minute cells. This wood is extremely porous; the cells of which it is composed are so numerous that a very thin slice of the wood, taken horizontally, exhibits the appearance of the finest possible open net-work.

Common acacia, or locust, (*n*) has wood which bears some resemblance to that of the oak; but it is very distinct from any other kind mentioned here; it wants the distinct primary rays so prominent in the oak, the rays of the locust being all nearly of equal breadth, and as slender as the secondary rays of the oak; here they are somewhat wavy. The cellular or tubular structure is also very different from that of the oak, being

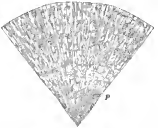


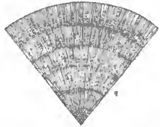


arranged in more regular order where they mark the concentric layers, and the spaces between the rays are furnished with many cells irregularly scattered over, of a size equal to those marking the concentric layers.

The wood of the fir (*o*) is distinguished from all others here enumerated by having very prominent coloured concentric layers, arranged very regularly throughout; and the cellular texture, though composed of cells sufficiently large to be seen with the naked eye, is not to be distinguished without very close observation.

The lime (*p*) has very slender equal rays and a minute cellular texture pervading the whole body of the wood. The concentric layers are scarcely perceptible to the naked eye. It may be compared to the wood of the poplar, but the network-like arrangement of the cellular texture is not so obvious in the former; the presence of the rays in the lime distinguishes it at once from the poplar.





The wood of the laburnum (*q*) is distinguished by its minute, regular, uninterrupted medullary rays, and by the broken beaded longitudinal lines of the tubular structure.

These characters of distinction being permanent and constant in all these different kinds of wood, will be found useful in cases where it is desirable to ascertain the kind of timber which may have continued sound for the longest period in any particular building or situation, and the contrary where its duration has been limited *.

The *leaves* constitute one of the most important conservative organs of vegetable growth; for on the free and healthy exercise of their functions depend the life of the plant and its progress to maturity, to say nothing of that universal interest and pleasure which is afforded by the diversified beauty of their forms and tints. The green colour of the leaves of trees has been proved, beyond all doubt, to depend chiefly on the influence of solar light and atmospheric air. Almost every distinct species and variety of plant, in its most healthy state, has its own peculiar shade of green: the yellow-green tint of the foliage of a healthy larch, would in that of a pine, spruce, fir, and cedar of Lebanon, be certain indications of disease and decay. The dissection of a leaf shews that it is composed of vessels, cellular tissue, and an epidermis. The green part of a leaf is, in fact, a continuation of the parenchyma of the bark before mentioned; and the midrib and nerves of the leaf are a continuation of the conducting and returning sap, and air vessels of the bark and alburnum. The under and upper surfaces of the leaf may be separated in an entire state from each other. These appear to perform different offices; the under surface is provided

* It would be of the greatest utility to the interests of planting were registers kept of the kinds of timber used in particular buildings; also the age of the tree which produced it, when felled, and the soil, and situation or climate, in which the trees were reared. Posterity would be grateful for such records of facts.

with numerous minute pores by which moisture and air are emitted and absorbed. The upper surface of the leaves of trees is supposed to be destitute of pores: this part always turns its surface to solar light*.

The leaves of forest-trees are either simple or compound; simple as in the common beech, and compound as in the ash, where several smaller leaves are attached to one foot-stalk. The foot-stalk of the leaf is terminated by a gland, which in deciduous trees, or those that shed their leaves in autumn, becomes indurated, and at that season readily separates from the branch or twig.

The midrib of the leaf is merely a continuation of the footstalk; this divides the body of the leaf longitudinally; it may be compared to the stem of the tree, for from it issue branches of various sizes, dispersed through the substance of the leaf in order resembling those of the tree. The first or largest series of fibres issue from the sides of the midrib, either in an opposite direction, alternately, or irregularly, according to the species of tree; from these secondary branches proceed a third and a fourth series, not however in such straight lines as in the former, but curving and anastomising, or opening into each other in all directions, and, in this last particular, they have a resemblance to the disposition of the minute blood-vessels of the animal economy. The difference in the disposition of the first and secondary fibres of the leaves is so constant in the individual plants of different natural genera, that it affords a very clear discriminating character by which they may be distinguished from each other, in the same manner as the wood of different kinds are identified by the concentric circles and medullary rays before mentioned.

The leaves of the oak (Quercus) have the secondary fibres few in number, and curved towards the sinuosities of the leaf; the third series of fibres are very prominently marked, and the fourth series extremely minute. The leaves of the Spanish chestnut (Castanea), belonging to the same natural order but to a different genus, have the secondary fibres nearly straight, the third series very numerous and curved alternately, the fourth series nearly as large as the third, and if we examine and compare the wood of the oak and the chestnut, we shall find equally marked distinctions between them.

In the beech (Fagus), which likewise belongs to the same natural order, but to a different genus to the above, the secondary fibres of the leaves are very prominent, and the third and fourth series minute, and of nearly an equal size, and the texture of the wood is equally distinct from that of the oak and the chestnut.

That the leaves of plants during the day emit oxygen gas or vital air, and absorb carbonic acid gas or impure air, has long since been proved. In the night or during darkness, vital air is absorbed by plants and unhealthy air emitted, and it would appear by various experiments on this important point, that when the supply of carbonic acid gas from the air and soil is greater, the emission of oxygen gas by the leaves during their exposure to sunshine is also greater, hence another cause of healthy plantations improving the climate of their neighbourhood besides that of shelter.

The leaves of trees being the great organs for elaborating the sap and fitting it to become converted into all and every product of the tree, whether timber, bark, seeds or fruit, render the facts relating to their structure and functions of high interest to the planter and forester; for they point out the danger of lessening their number beyond a certain extent, as in excessive

* For a minute and interesting account of the varied forms of these pores, and of their number on different plants, see Part I. 'of Vegetable Physiology,' published in the Library of Useful Knowledge.

pruning, or of suffering the leaves to be crowded too much, so as to exclude a free admission of light and air, as happens when trees are planted too close together, and judicious thinning and pruning are neglected.

The seeds of forest trees. Seed consists of three principal parts: 1st. The *cotyledons*, or seed leaves;—2dly. The *rostel*, or first radicle, which descends into the soil, and becomes the root of the tree;—3dly. The *plumula*, which ascends, and becomes the stem, bole, or trunk. The rostel and plumula are closely united in the seed, and there constitute what is termed the germ, or embryo of the future tree. This is an essential part of the seed, for however healthy in appearance the seed may appear, if the germ be injured, the seed never vegetates. The cotyledons or seed-leaves contain a farinaceous substance which is the source of nourishment to the radicle, until established in the soil and fitted to perform its proper office in the development of the stem and proper leaves of the plant. It may be useful in this place to mention, that the seeds of forest trees may be classed under the following heads or general characters, indicating peculiar points to be observed in the practice of sowing them.

1st. *Seeds farinaceous, and covered with shells, nut-seeds.* To this class belong the oak, Spanish-chestnut, beech, horse-chestnut, walnut, hazel, hornbeam, plane, sycamore, maple, and ash, to which may be added, though not strictly belonging to the group, the birch, alder, and lime. The first seven kinds, from the farina they contain, are least adapted for keeping out of the soil, and the same cause renders them more difficult to preserve in the soil when sown, by inducing the attacks of mice, birds, and other vermin. The spring is considered the best season for sowing, and the seeds must therefore be preserved carefully during winter; the most approved mode is to spread them out in their layers on a cool dry floor, but previously to this they should be thoroughly dried by the sun and air. The smaller kinds of seeds after being sufficiently dried, may be kept in a smaller space. The seed of the oriental plane (*Platanus orientalis*), however, succeed best when sown immediately as it is perfected. When sown, these seeds require different degrees of covering in the soil. The larger seeds, as those of the chestnut, oak, &c., should be covered with two inches of mould; for the smaller seeds of the plane, sycamore, hornbeam, maple, and ash, it will be proper to mix with them sand, in quantity about equal to their bulk, placing the mixture on the ground a foot in thickness, and covering that with an inch thick of mould. The birch may be sown immediately as it is taken from the tree, or preserved in the seed-loft until spring. When sown, the birch is generally covered half an inch with mould, the former seeds with one inch.

2nd. *Hard seeds, or stones covered* with a pulpy fruit. The proper covering of these seeds is so hard, as to have acquired for them the name of stones. In this class are the cherry-tree, mountain-ash, whitebeam, yew, holly, pear, crab, and thorn. With the exception of the cherry-tree, all these remain in the soil one or two years before they vegetate. To obviate the irregular vegetation of these seeds, which is attended with loss of time and inconvenience, the practice of preparing them for sowing by what is called pitting has been adopted; this is done in the manner above mentioned for the hornbeam, plane, &c.; but as one, two, or even three years in the pit or preparatory bed are wanted for some of these seeds, it is requisite after they have lain a certain time in the pit to uncover them and turn them over, so as to assist in the separation of the pulp from the stones. Holly berries require one year at least to prepare them for sowing; mountain ash, whitebeam, yew, and ash lie one year; the cherry readily vegetates in the same spring in which it is sown.

3rd. *Leguminous, or bean seeds.* These, as regards forest-trees are confined to the common acacia, or locust-tree (*Robinia Pseud-Acacia*), the glutinous Robinia (*Robinia viscosa*), and the laburnum. These seeds vegetate freely when sown from the tree, but it is the general practice to preserve them until spring in a dry, cool place. When sown, they require to be covered with about three-fourths of an inch of mould. If sown too thickly, that is, less than one inch seed from seed, the plants soon injure one another and become diseased.

4th. *Light seeds.* Under this head we enumerate smooth elm, and mountain elm, the poplar, and the tree willows. These seeds being light, and separating freely from the tree when ripe, require care in collecting, as otherwise they are liable to be dispersed and carried away by the wind. They vegetate quickly and may he sown so soon as they are ripe. Spring however is preferred, as tender seedling plants are subject to injury from severe weather in winter. They should be covered to the depth of one fourth of an inch of fine sifted mould.

5th. *Resinous seeds* are those of coniferous or fir-trees. Their vegetative power when cleaned or separated from the cones, is not to be preserved if they are kept out of the ground for any considerable length of time, and they require particular care in sowing. The soil of the beds ought to be of a light sandy nature, enriched with the vegetable mould of decayed tree leaves, or well decomposed dung. If a proper quantity of the former manure be added, and well incorporated with the sandy loam above described, it will bring that soil to a suitable texture. The seeds are borne in cones furnished with scales of a hard woody consistence. The cones of the larch with much difficulty part from the seeds, and various means have been adopted to effect that object. The best is that of first opening the cone, or dividing it lengthways into two or four parts, then placing them on a kiln and drying by a very gentle heat until the valves begin to open, when they should be taken to a proper floor and threshed: the seeds may then be separated by a sieve. The cones of the Scotch fir and the spruce require also the aid of the kiln; but the seeds part from the cones easily, and the splitting of the cones is superfluous. The spring* is the best season for sowing these seeds. The soil of the seedling beds should be in as finely a pulverised state as possible for their reception.

The seed of the stone pine requires to be covered with one and a quarter inches of soil, the silver fir and pinaster with one inch, the Weymouth pine with three-fourths of an inch; the Scotch fir, Norway spruce, balm of Gilead, and cedar of Lebanon with half an inch of soil. The cedar of Lebanon is best sown in boxes placed in a warm or sheltered situation. The larch should not be sown so deep; a covering of a quarter of an inch of soil suffices. The white, red, and American spruce firs, having smaller seeds, require a slighter covering of a fifth of an inch deep, and the texture of the soil should be even lighter, which can be easily effected by adding sand or a larger proportion of the mould of decayed tree leaves. Heath soil, or bog soil, containing a good proportion of fine siliceous sand, has been found very congenial to the vegetation of these seeds.† Shading

* If the winter happened to be favourable, and the depredations of vermin were completely prevented, the balance would be in favour of sowing the seeds of the fir and pine in autumn, and which would be the case also with every description of forest-tree seeds, the hard or stone seeds probably excepted.

† This description of soil has been erroneously supposed to be injurious to transplanted firs, and implements are used to remove the heath soil from the intended sites of the plants, in order that the roots may be inserted in the subsoil of gravel or sand, of which the subsoil almost always consists. The roots of the heath while alive are the cause of injury, not the nature of the soil.

from hot sunshine is highly beneficial to them, indeed, indispensable in some states of the weather, for the thin covering of soil which is necessarily allowed them is soon affected by the action of the sun's rays, and sudden drought quickly destroys the tender seedlings. The thickness in which the seeds should be sown, according to the respective kinds, is on an average from three to four on a square inch, so that the plants when produced stand not nearer to each other than that scale of distances.

The artificial fine state of culture of the soil in the seed beds, rendering it less retentive of the due degree of moisture than is required, the beds should be consolidated before and after the seeds are sown, either by the use of a roller, or by the spade.

In concluding this practical view of the structure of forest trees, and of those natural agents, which obviously influence the growth of plants, it may be useful to take a similar view of the process of vegetation. A perfect aud healthy seed consists of an outer covering, cotyledons, radicle, and plumula. When sown in perfectly dry earth, it remains unchanged; if in an excess of moisture, it loses its vegetative powers and decays: in neither case it vegetates. When the temperature of the soil is below a certain point, all vegetation is suspended. Should the soil and the temperature be perfectly favourable to vegetation, yet if the seed be not planted shallow enough to be within the influence of atmospherical air, no vegetation takes place. Different species of seeds require different degrees of moisture, temperature, and atmospheric influence, to render their vegetation the most healthy and perfect. The natural constitution of different soils, as regards their respective properties of retaining or easily parting with moisture; the proper season of sowing, as regards the temperature of the soil and the atmosphere, by whatever local causes subject to be influenced; and the respective depths to which the seeds should be deposited in the ground, as above mentioned, apply directly to the skill of the cultivator to aid, modify, and assist these primary essentisl agents of vegetation; and on the right adjustment of these depend the success and just reward of the planter in this first stage of the process of his art.

In whatever position the seed is placed, the radicle first bursts the covering, and takes a downward direction into the soil, where it becomes fixed, and protrudes, at right angles from its sides, numerous rootlets, which in their turn emit others; then, and not till then, the cotyledons rise above the surface and expand, shewing the plumula or bud of the stem, which now advances in growth and unfolds the proper leaves. After the leaves are fully expanded, the communication of the pith with the buds, formed or forming, at the base of each leaf-stalk in the angle made hy that and the stem, may be traced. The loss of either of these organs of the seed at an earlier period would have prevented farther growth; for if the cotyledons had been seriously injured or taken away, the radicle and plumula would have died; if the radicle had been removed, the same effect would have followed; or if the plumula bad been taken away, the plant would have made no farther progress. But as soon as the formation of the germ of buds is effected, as now stated, the cotyledons may be removed; the summit of the stem and the lower extremity of the radicle may be taken away, and the plant will reproduce others. It is during the previous stage of growth that the attacks of insects prove so fatal to seedling plants, and reqnire the utmost care of the planter; and hence also the greater care and attention that is demanded in the preparation of the soil for seeds than for the reception of transplanted trees. This also points out the danger of injury to the vegetating seeds, by disturbing the seed beds before the

plants are perfected. It is in these early stages of growth, that the foundation is laid for the future health, beauty, and vigorous growth of the tree. The fibres of the root, with the minute spongeols before mentioned, now imbibe and send up the food of the plant to the leaves, where being spread out to the influence of solar light, heat, and atmospheric air, it is elaborated and returned through the foot-stalk by the longitudinal vessels of the inner bark to the root, depositing in its course, or in conjunction with the original fluids of the cellular texture forming, the various substances and secretions peculiar to the tree. That the sap ascends by the longitudinal vessels of the alburnum, sap, or soft wood, and descends by those of the inner bark, seems to be proved by the experiments of Mr. Knight and others, who have more intimately investigated this part of the subject. That a lateral movement of the sap goes on at the same time, and in conjunction with the ascending and descending movement, appears equally certain*. Every individual leaf of a tree is furnished with its own particular series of vessels for the course of the sap, and not only prepares and elaborates the sap for the increase of substance of its own branch, but also for that of the parent stem and root. Hence it is that trees regularly furnished with branches from the base upwards have more tapering stems, than trees with branches confined to the upper half of the stem, the increase being equal, from the point where the branches begin, downwards to the root; or, in other words, whatever length of stem from the root upwards is destitute of branches, that part of it from the period of losing them increases in size equally throughout†. Without a just knowledge of this principle in the economy of vegetable life, the important process of pruning in the culture of forest-trees cannot safely be performed by the forester: that the sap never ceases wholly to move‡ is evident in the increase of the roots and buds during winter when the plant is leafless; but its ascent is particularly distinguished for greater force and activity at two periods of the year, spring and midsummer. The ascent in spring is the strongest, and continues until midsummer, gradually diminishing in force as the new branches and leaves are perfected. This generally takes place about the beginning of July, when an apparent cessation of ascending motion in the sap immediately succeeds, and continues usually for the

* The sap in ascending is farthest removed from the action of solar light, heat, and atmospheric air, in descending it is nearest to these important agents, receiving their impulse through the medium of the green cellular tissue or parenchyma. The offices of this organ in transpiration and inhalation, may be compared to that of an universal leaf covering every part of the stem and branches of a tree.

† This fact may be demonstrated most conveniently, by pruning the lateral branches off quite close to the stem of a young fast-growiog tree, leaving a certain number to form a top, and to keep up the growth of the plant.

‡ The term *circulation* has been objected to as improper for describing the course of the movement of the sap in plants; because a point from whence the movement begins, and to which it again returns (as for instance, the heart in animals,) has not been discovered in plants; for in these the sap is periodically exhausted in the increase of the substance of the tree, and its place periodically supplied from the soil to the spongeols of the roots. The term periodical is here understood to apply to the effects observed, by the practical planter, of the spring growth, midsummer growth, and leafless or winter cessation of growth, annually in the progress of every forest-tree. That the roots of these plants (as long as their vital powers continue to act) continue, *without intermission*, to imbibe fluid or pabulum from the soil, however small in quantity that may be at certain seasons, seems highly probable; as also that a movement or circulation of the fluids of the cellular texture, however languid it may be, exists even in the leafless tree. But there are plants, such as the hyacinth, potatoe, onion, &c. &c., which remain two or three months annually during their progress of existence, without a possibility of imbibing anything whatever by their roots, rootlets, or spongeols, inasmuch as during that period of their existence they are destitute of these organs wherewith to imbibe.

space of a fortnight or three weeks, according to the age of the plant and the state of the weather. A second ascent of the sap, and growth of shoots now take place, but with diminished vigour; unless from accident, disease, or unfavourable weather, the spring growth has been checked, and the first flow of sap prevented from being exhausted in the production of branches, leaves, and blossoms. It is worthy of remark, that those shoots which form fruit, flower, or seed buds, have seldom if ever any second growth; but remain without increasing in length until the next spring. The midsummer growth is almost always confined to those branches which carry wood buds only. After the second growth is completed, the effects of the descending sap in the formation of new bark and wood is very apparent in the healing up of wounded parts of the stem and branches, which now proceeds with more activity than during any other period of the year. Branches pruned off after the midsummer flow, seldom are followed by shoots from the edges of the wounds caused by their removal, which always happens, more or less, when pruning is performed on free growing trees after the fall of the leaf, and before the full development of the spring shoots and leaves: it is to be observed, however, that the reproduction of branches from the edges of a wound is greatly assisted by leaving a portion of the branch or shoot, or its parent branch or stem, but impeded when a branch is pruned off close to the stem. What was before stated regarding the offices of the pith and medullary rays in originating the buds of shoots and branches, will be confirmed by these facts.

Food of Plants.—Those substances which the roots of plants take up from the soil, and those which the leaves or green system of the plant inhale or imbibe from atmospheric air are comprehended under the name of the food of plants. This part of vegetable physiology has long engaged the anxious inquiries of science, as well as of practice. The question is one of much importance, inasmuch as a perfect knowledge of what constitutes the food of plants generally, and individually, would with unerring certainty point out the means of fertilizing soils, defective in any respect for bringing to perfection the species of tree most desired; would indicate at the same time the most proper substances to be used with the greatest advantage, the exact proportions in which they should be mixed, the mode of applying them, and the best process of manual culture or working the soil, for elaborating and preparing them for absorption by the roots. Of late years great progress has been made in the investigation of this part of vegetable physiology; the labours of T. A. Knight and M. Dutrochet are, in particular, highly valuable, but much still is required before even an approximation to the solution of this important question can be attained. The structure of the root shewed us that whatever kinds of substances are conveyed or by it introduced into the plant, such substances must be in a minute state of division, or dissolved in water. The analysis of a soil demonstrates the soluble substances it contains. These have been found to be chiefly vegetable extract, combined with smaller proportions of a few of the neutral salts, as sulphates of potash and lime, muriates of lime and soda, or common salt; this last, in every instance of our own individual experience, is always in a larger proportion to the other saline matters, and is never altogether wanting, as is the case sometimes with the sulphates and muriates of lime. The vegetable extract, except as regards its presence in poor clays and siliceous sands*, is always in a

* The soils here alluded to, the results of whose chemical examinations have led to the above conclusions, were of almost every kind or description to be met with in practice, comprising the various degrees of fertility intermediate between the poorest sand and the most tenacious clay.

larger proportion to the saline matters. It contains the elements of which the substance of a tree is composed, viz., carbon, oxygen, hydrogen, and azote. The extract, however, obtained from soils is never perfectly pure, but is always more or less (in all our experience) combined with mucilage, and frequently with soluble animal matters. In alluvial soils distinguished for fertility, the soluble extract is found in the largest proportion; five parts of vegetable extract in four hundred of the soil is considered the maximum for healthy vegetation.

The soils called alluvial have the power, it is evident, of preserving this substance in the decomposing vegetable matters which supply it, and of giving it out to the roots of plants, or rather to the water of the soil, slowly, but in that seasonable and regular manner which is the most conducive to the healthy exercise of the functions of the roots. It is evident that in some alluvial soils this extractive vegetable matter must have remained from a remote period uninjured for the purposes of vegetation *. In siliceous, sandy, and gravelly soils, the reverse of this takes place, for the manures applied to these is speedily decomposed, and the extractive matter given out, comparatively, at once: hence the constant repetition of manures required by these kinds of soil to keep them productive. When clay, mild lime, or chalk, fine siliceous and calcareous sand, and impalpable vegetable matters are so intimately combined as to constitute what is termed the best loam, the extractive matter, whether of long duration in the soil or in recently supplied manure, is economized and given out to water, and to the roots of plants, in a similar degree of effectiveness as in the alluvial soil: on the contrary, when clay is the chief earthy ingredient of a soil, the vegetable matter is either retained in the manure, or given out partially; the lower temperature of the clay, its great adhesive powers, and compact texture, uniting to produce this result †. The food of plants supplied by atmospheric air, whatever proportion it may bear to that supplied by the soil, is at least equally essential to the growth of plants, for they can no more exist without that, than they can exist without the soil. The curious structure of the leaves shews how admirably they are

* Extractive matter, when separated from the saline compounds with which it is usually accompanied in soils and in vegetable manures, and exposed to the air, soon decomposes or putrifies. It also loses its solubility in water after two or three solutions in and evaporations of the water. It is a constituent of the nutritive matter of the food of the larger domestic animals, but in the process of digestion it is not retained in the body of the animal for the purposes of life, but is voided with the fæces. The pasture grasses, corn, or annual grasses, green or soiling plants, as clovers, lucerne, sainfoin, vetches, turnips, mangel wurzel, and carrots, all contain extract as an essential constituent, which, with the woody fibre and saline matters of the vegetable, are returned again to the soil.

† The great benefit resulting to clayey soils from the process of paring and burning, is that of improving their texture, and, even in some degree, their temperature or latent heat. A certain degree of what may be called a circulation of the water and air of a soil is essential to its power of preparing the food of plants depending on the soil. Where this power is wanting, as in the case of a perfectly stagnant clay or peat, or a sandy soil, with a subsoil impervious to water, vegetable matter, however ample, in these soils will remain inert and afford no support to trees, or, at least, they will not long exist if planted under such circumstances. So obvious is the effect of this principle of circulation of water and air, (if we may be allowed the expression,) that some have undertaken to prove that the fertility of soils depended on it alone, and that water and air constitute the sole food of plants; and that even animal and vegetable matters were no farther useful than as contributing to the temperature and texture of the soil, fitting it for the more ready circulation of these, and more readily presenting them to the roots of plants. However erroneous the conclusion may be, the principle of practice inculcated by it is essential to the successful cultivation of trees, for on it depend the processes of paring and burning, draining, trenching, digging, and in a word the judicious adoption of the various means which are employed for pulverizing and comminuting soils.

fitted to imbibe air and moisture. The essential constituents of atmospherical air are oxygen and nitrogen or azote; and it holds in solution carbonic acid gas and water; they are elastic and invisible, but can be separated from each other, and their bulk, or volume, and weight can be determined, and their properties satisfactorily ascertained *. Oxygen has received the name of pure or vital air, because animals cannot respire if the air they breathe be deprived of it, nor can seeds vegetate unless it be present in the soil and air in which they are placed. It enters into the composition of the vegetable and most other acids, and largely into that of sugar and extract. It forms about one-fifth of the air of the atmosphere. Carbonic acid gas constitutes about a thousandth part of atmospherical air, its basis carbon is well known in the state of charcoal, and is the fundamental constituent of wood. Nitrogen, or azote, constitutes about four-fifths of the atmospherical air. Its offices have not been so clearly discovered: with much reason, however, it appears to be employed in the formation of several products of vegetation, as gluten and albumen, and in modifying the actions of the other components of the air. It is remarkable that carbonic acid gas being so largely produced by numerous artificial and natural processes constantly going on, as in the putrefaction of substances of every kind, in fermentation, combustion, respiration of animals, and, during darkness, by the green system of the whole vegetable kingdom, so small a portion only of it should be found permanent in the air, varying from $\frac{1}{300}$ to $\frac{1}{1000}$ part as the minimum and maximum. It is heavier than the other constituents of air, and it is lost from the atmosphere, or from wherever it may exist in plants only, and forms the bulk or basis of every kind of wood; it must be at present considered as being largely taken up by the roots of plants. Water, the last mentioned constituent of atmospheric air, enters into it in the state of vapour. The quantity of it suspended in the air is supposed to

* The elasticity of the constituents of atmospheric air is so powerful, that when, from local causes, one ingredient is generated in undue proportion to the others, the most perfect analysis of the general air in the immediate neighbourhood of the spot where this circumstance happens cannot detect any difference in the proportions of the proper constituents from that of the air of the most healthy region. The atmosphere of a crowded city and that of an open or moderately sheltered alpine region, afford by analysis the like number and proportion of ingredients or elements; but notwithstanding this, the influence of the air of these two situations on vegetation is very different. There are certain plants which will not grow in the atmosphere of a crowded city, and there are others which thrive in the former, and will not continue long in that of an alpine air. Some of the followiog plants grow freely in the atmosphere of the crowded parts of the city of London.

Plants that grow freely.
Sycamore.
Elms.
Mulberries
Ivies
Virginian Creepers
Vines
Oriental Planes, bulbous and tuberous-rooted plants, except Snowdrops.

Plants that exist for only a few years in perfect health.
Laburnum.

That exist in health only a limited time.
Privets
China Roses
Alpine Plants, scarcely ever produce flowers.

Since the above list was written, the Bedford Conservatory, or new flower and plant market, Covent Garden, London, has been erected by John Duke of Bedford, and this interesting feature to the ornament of the metropolis will afford extensive means to determine what species of hardy as well as of tender plants will thrive in the atmosphere of so large and crowded a city as that of London. Since this part of the market was completed in the month of June last year, the following plants may be mentioned as having thriven best. The orange, *Citrus aurantium*; camellia, *Camellia Japonica;* rhododendrons, *R. ponticum*, *R. maximum*, *R. punctatum*. Some kinds of pelargoniums, *Geraniaceæ*. Heaths, particularly *Erica tubiflora*, *E. cylindrica*, *E. persoluta*, *E. cupressina*, *E. odora-rosa;* *Acacia verticillata*, *A. armata*, *Epachris grandiflora*, *E. pungens rosea*.

vary from $\frac{1}{60}$ to $\frac{1}{100}$ part of the atmosphere, being greater as the weather is dry and hot, at which time it is most useful to the growth and health of plants, being absorbed by the leaves *. It is clear that water constitutes immeasurably the largest portion of what is taken up by the roots and furnished to the plant by the soil; and when it is considered that water is composed of oxygen and hydrogen, it cannot be supposed to act merely as a vehicle of the food of the tree; it contributes, probably, to the increase of the solid parts of the living structure by decomposition into its elements, through the agency of the vital powers.

Such are the general facts disclosed by chemical examinations of the soil and atmospherical air, with respect to the substances supplied by them to plants as food. An analysis of the sap itself immediately after its absorption by the spongeols of the rootlets, and before it enters the ascending vessels of the alburnum,† would probably leave nothing more to be desired on this important subject, that might apply to the operations of the practical planter. The sap hitherto examined chemically, has been taken from the alburnum of the tree, and consequently after it had undergone a change in its original constitution, or that which characterised it at the moment of its entering the spongeols of the rootlets immediately from the soil. That the sap undergoes a change in the ascending vessels of the alburnum before it is acted upon by the leaves, has been proved by Knight and others. In these instauces, the sap extracted from the lower part of the tree, contained much less saccharine matter, than that taken from a more elevated part of the stem. According to Vauquelin, water, extract, mucilage, sugar, and acetic acid, combined with potash or lime, are found in sap taken from the alburnum or ascending sap vessels of the birch, elm, and beech; but these vary in the sap of different species of trees. Saccharine matter is most abundant in the birch and sugar maple. These results, however, afford but little light in the investigation of the question, as we know that the same sap which produces the acid, astringent crab, produces also the saccharine, aromatic pippin. By the action of heat, light, air, and the peculiar organic structure in different species of trees, under the influence of the vital power, are those substances which are soluble in water, or saccharine and mucilaginous fluids converted into insoluble or resinous and oily substances.

* The value of vapour in air to the health of plants, is well known and appreciated by every skilful cultivator of tropical plants in an artificial atmosphere, as well as by the successful forcing fruit and flower gardener in the hothouse. Plants are enabled by vapour in the air to withstand the effects of extreme heat and drought, which otherwise would destroy tha organization of the leaves. We ourselves hava found the leaves of the provinee rose, when in an artificial atmosphere, at an early season (and when its vital powers could not be so strongly exerted, as when under the circumstances of its naturat season of growth and exposure) to unfold and increase in healthy growth when subjected for a certain time, each day for the space of a fortnight, to hot air strongly eharged with vapour, whila leaves of the same species did not unfold, or when unfolded previously to the application, shrivelled up and perished under the application of a dry current of air, of the like temperature, and though all other eircumstances were equal.

† The rapid communication which exists between the spongeols of the rootlets and the leaves at the extremity of the tree, as evidenced by the sudden effects produced on the latter by the application of water to the roots of a tree whose leaves have become flaccid or drooping from the want of it, warrants the idea that the ascent of fluids from the roots to the leaves is more direct than our knowledge of the structure of the vessels will allow, or that a principle exists in the vegetable structure analogous to that of the irritability of the animal fibre. The well known experiments of Hales to ascertain the force with which the sap of trees ascends, shew that the sap of a vina branch four or five years old rises with a force considerably superior to atmospherical pressure. Plants having the leaves firm and glossy, exhibited proportionally less force in their ascending sap. Vide *Vegetable Statics*, vol. I., p. 114.

From these facts we may conclude that soluble substances, chiefly vegetable extract, mucilage and carbon, with water as a vehicle and a component, presented to the roots of plants under circumstances varying according to the chemical constitution, and mechanical texture of soils, adapted to the peculiar habits or natural wants of different species of trees, as the oak for instance, and the larch, constitute the food of trees supplied by the soil to the roots; and that atmospheric air of a certain temperature, and degree of moisture, and with freedom of circulation, constitutes that other essential part of the nourishment of trees, which is taken up by the leaves or green system of the plant.

Air, like water, requires a certain freedom from stagnation or confinement to render its nourishing and invigorating properties available to the leaves of trees; when comparatively stagnant, its valuable properties become lost to plants. This is indicated by the disappearance of the green colour from the leaves, which soon drop off, and are not reproduced, but the branches die; a few remaining alive at the top of the stem, may continue the existence of the tree for a few years, but without adding to its girth or solidity of contents. These are the invariable effects of stagnant air, the most common and indeed the only cause of which in plantations is the neglect of seasonable *thinning* of the trees, and the removal of dead and decaying vegetable matter as it is produced.

The putrefactive fermentation of spray and brushwood left in close plantations where the circulation of the air is confined, produces fetid gaseous matters, alike hurtful to animal and to vegetable life; the growth of moss on the bark of trees is promoted hy it, and whenever this becomes general in a plantation, the progress of the trees is greatly retarded. We cannot better illustrate the importance of attending to this principle of practice in the planter's art, than by stating an instance kindly communicated to us by high authority * on the subject: in many places over an extent of upwards of a thousand acres of the plantations at Blair Adam the prunings of spray and brushwood, and the loppings of the trees thinned out, for which there is no sale in this country, had been allowed to accumulate for many years. The injurious effect was so remarkable, that the proprietor determined to have the accumulation removed. This was done at an expense not very considerable. Ever since the accumulation has been prevented by having a squad of women and boys, to clear away and brush after the woodcutters or pruners. The expense of this operation has been overpaid by the increase of growth, and it is evident that it has added greatly to the value and beauty of the woods, as well as to the growth of underwood †.

To have entered more minutely into the details of the vegetahle physiology would have been incompatible with the scope and design of this essay, and to have dwelt less on those principles which bear directly upon every operation of the planter's art, would have rendered the practical details which follow, more obscure and less instructive.

* The Right Hon. Lord Chief Commissioner Adam.

† We have had the gratification lately of examining a considerable part of these plantations, and at the same time of witnessing the triumph of art in rearing valuable timber on situations of great elevation, and in many places more or less elevated, in which wet and undrained land presented difficulties to be encountered and overcome.

Chapter III.

Of the different modes of rearing forest-trees :—By sowing the seeds on the spot where they are to remain for timber. By sowing the seeds on nursery beds, and afterwards transplanting the young trees to their timber sites. Modes of propagating and of transplanting, preserving, and training, proper shoots or suckers produced by coppice roots or stools. Comparative advantages and disadvantages of the different modes; and of simple and mixed plantations.

Before the seeds of forest-trees are sown on the spots where the plants are to remain for the produce of timber, or the young trees are transplanted from nursery beds to their timber sites, the land should be fenced and properly prepared for their reception. As fences, however, are constructed of various materials, turf, or earth, stones, wood, and thorns, or other armed shrubs, and the judicious adoption of the best kind of fence depending on local circumstances, this part of the subject, perhaps, may be more conveniently discussed under a separate head. It has been supposed, with good reason, but certainly without the evidence of such clear and undisputable facts as are absolutely necessary to bring full conviction to practical men, that when forest-trees are reared immediately from seed, and consequently whose tap roots, pruper roots, and rootlets have never been disturbed or curtailed, they grow faster, attain to earlier maturity, and produce sounder timber, than such as are transplanted from nurseries. The facts brought forward respecting the structure and growth of trees confirm this opinion; but when useful or profitable planting is the object of the planter, it is necessary to inquire whether these apparent advantages are not lost for the most part, or entirely, in the extra cost or expense which attends the execution of this method, in comparison to that of transplanting; or whether the extra feet of timber, that may be thus gained, will repay with profit the increased cost of production. A detail of the different processes of these two first-mentioned modes of rearing forest-trees may assist materially in coming to a just conclusion on this important questiou. The oak being one of the most valuable of forest-trees, and its roots penetrating more directly, and to a greater depth in the subsoil than those of any other tree approximating to it in value, it has been thought to suffer great injury by transplanting, and has, therefore, been chiefly insisted upon to be raised immediately from seed on its timher site.

Should the land on which it is intended to rear oak immediately from seed, be not in a clear state of tillage, it must be brought into that state by the most eligible means; these, of course, will depend on the nature of the soil and cundition of its surface. If the soil to be sown is clayey and tenacious, retentive of moisture, and covered with coarse plants, as sedges (carix), rushes (juncus), thistles (carduus), and turfy hair-grass (aira cæspitosa), the surface should be pared and burnt, the ashes carefully applied, and the soil ploughed as deep as the nature of the subsoil will permit. It should have a clear out summer fallow, with repetitions of cross ploughings and harrowings, as often as is necessary, to bring the land to a friable and deep tilth. It should be ploughed into ridges twelve feet wide, sufficiently high to give an inclination from the crowns of the ridges on each hand to carry off all surface water, and be well water-furrowed. A dressing should be applied of compost of dung, coal ashes, road scrapings, sand, &c., or any other manure that can be procured, which may have a tendency to divide the texture of the tenacious soil, and make the tilth friable and deep. This part of the process will be found highly useful, and also necessary to insure a well-founded hope

of success. An application of lime, when it can be procured at a reasonable cost, will also be found highly useful.

Should the effects of these operations have been powerful enough to bring the land to the essential condition of cleanness, depth, and fineness of tilth required, the soil will be ready for the reception of the acorns in the spring. Unreclaimed lands, however, of this description can seldom be prepared as above by the out summer's fallow only; and in such cases it will be necessary to continue the process of fallowing for another season. A green crop fallow may be now adopted; and should the weather be favourable, the crop will probably cover the expense of cleaning for that season, or at all events considerably lessen the cost of fallowing. The choice of the crop to be employed must be determined by the condition or adaptation of the soil to certain kinds of green crops, and the greater local demand that may be for one kind of produce more than another. The following may be pointed out: Swedish turnips, rape, potatoes, cabbages, and winter vetches. For these crops it may be unnecessary to add, that the row and ridge system of culture should be adopted, as affording the greatest facilities for cleaning and pulverizing the land, either by the hand or horse-hoe, and thereby obtaining the great objects in view in their most perfect state, and at the least comparative cost. Green crops are here mentioned for fallow, because they exhaust the soil less than corn crops, and also afford the means of destroying every kind of weed much better; but if a corn crop should promise better advantages than a green crop, and secure the cleaning and pulverization of the soil, there can be no possible objection to it, the extra manure given with the corn crop supplying the loss supposed to be caused to the soil. As soon as the crop, of whatever kind, is reaped and carried, advantage should be taken of the first favourable weather to have the surface scarified, horse-hoed, or skim coulter ploughed (according to circumstances of convenience, in the possession of one or other of these implements), and the weeds collected by the harrow, and by the hand if necessary. It is, in this case, the safest mode to burn the weeds, for their seeds and the eggs of insects are thereby more certainly destroyed. The land should now be ploughed up to stand the winter's exposure. The mode of ploughing is of importance at all times, but most particularly so when the full effect of frost and winter weather is required to divide and ameliorate an adhesive clayey soil. When the furrow slice of a soil of this description is reversed, or laid quite flat, the weight and tenacity of the soil consolidate its surface almost immediately, and obstruct the action of the weather in breaking down the texture of the soil, as well as that of the harrows in raising a tilth, or the greatest depth of mould for covering the seeds. But when the furrow slice is raised up so as to lie at about an angle of 45°, the greatest possible surface of the soil that ploughing can accomplish is exposed to the direct influence of the atmosphere in the most effective manner*. As soon as the weather will permit in February, the harrows should be used to raise as deep a tilth as possible; and when this mould is in its driest state, the last ploughing should be given: the reversing of this comparatively dry and ameliorated mould to the bottom of the staple of the soil is of great advantage to the growth of the plants.

* 'Hally's plough' is admirably constructed for this mode of ploughing.

It may be supposed that the preparation of the soil has here been too minutely dwelt upon; but being a part of the subject of considerable importance, in many instances too little attended to, and from the neglect of which failures of considerable extent have had their origin, as regards this mode of rearing oak trees, we have ventured to state thus much on the point.

By the beginning of March favourable weather will have occurred to use the harrows so as to obtain a proper depth of surface mould in which to sow the seeds; but it is essential that the greatest possible depth of mould be obtained, though the time of sowing be delayed until the middle of that month, but which should be avoided if possible.

There are two distinct varieties of the British oak, differing in the quality of the timber and quickness of growth. In collecting the acorns for sowing, therefore, it is of consequence to select those of the most valuable variety. The discriminating characters of these will be pointed out hereafter, when we enumerate all the different species and varieties of forest-trees: here it will be sufficient to mention, that the most valuable variety of the oak is distinguished by having the acorns on footstalks (*Quercus Robur pedunculata*), and the less valuable variety by bearing the acorns without footstalks (*Quercus Robur Sessiliflora*). If it were possible to have the land in a fit state for sowing in autumn, as soon as the acorns were ripe, and the attacks of mice, birds, and insects upon them could be securely guarded against during the winter, the autumn would be doubtless the most favourable season for sowing; but as this can seldom be done, the acorns must be carefully preserved until spring, by spreading them out in a thin layer on a dry, cool floor. When placed in sand, unless the same be perfectly dry, the acorns are apt to vegetate; and the same thing happens when they are placed in heaps, or in too thick a layer.

The land being thus prepared for the reception of the seed, and the acorns ready, drills or furrows should be drawn with the hand-hoe two inches deep, and at intervals of four feet. In order that the rows of plants may not obstruct the surface-water from passing off by the declining sides of the ridges, a point of great importance in this kind of soil; the furrows for the seed should be at right angles to the ridges. The one-horse drill which, under other circumstances, would be the most economical mode of drawing the drills, is inconvenient here, on account of the curve of the ridges and the open drains in the furrows, over which the drill would have to pass*. The acorns should be dropped in the furrows at about two inches apart: this thick sowing is to guard against the numberless casualties which thin them in the course of their vegetation in an exposed field or common, and also to allow the selection of the strongest seedlings to stand for timber—a part of the duty of the planter requiring great attention, and which hitherto has scarcely been attended to, or but incidentally. The acorns should be carefully covered with two inches depth of mould. The back of a large wood-rake will be found to fill up the drills effectually and with dispatch. As soon as the young plants appear above ground, the soil should be hoed, and every appearance of weeds destroyed. Hand hoeing must be repeated as often as weeds appear, or the surface of the ground becomes hardened; in fact the land must be kept in as clean a state, and as free from weeds, as the best managed seedling beds in a nursery garden, or disappointment and failure in a greater or less degree is certain to follow. The surface of a soil of this description, as regards the successful germination of seeds and growth of seedling plants, requires to be kept always in a friable, loose state; for if once it becomes hardened and cracks, the seedling plants will be injured, their leaves assume a pale sickly hue, and their growth will be greatly retarded. Where the plants are suffered to remain long in this state, the sap vessels become contracted in the bark and leaves, and the plants never regain that vigour of constitution which, in this stage of their growth, is so essential to their future perfec-

* These drains are recommended to be made immediately after the ridges are formed, that the land may have the benefit of their free action a twelvemonth at least before the sowing of the seeds.

tion. The stem and branches remain stationary, until the roots, by the influence of a favourable season or two, sometimes force a new stem from the base of the stinted one, which in the course of one year overtops it, and becomes the stem or body of the tree; the original stem, taking the place of a secondary branch, soon disappears altogether. This is the invariable consequence when the growth of the plant, under these circumstances, is left to the unassisted efforts of nature—a fact upon which is founded the practice of cutting down to the surface of the ground stinted young plants, in order to produce superior stems, which always succeeds with the oak, chestnut, and ash, but never with coniferous trees of pine and fir.

During the summer of the second year, the plants which have escaped the attacks of the enemies before alluded to will be strongly marked in the rows, and the horse-hoe may now in consequence be substituted for the hand-hoe: this will be found very beneficial as attaining the great objects of perfect weeding, pulverizing, and rendering friable and porous the surface of the soil at a diminished expense. The rows, however, will require to be looked over and handweeded with care.

Should the plants stand nearer to each other than one foot, they must be thinned out to that distance in the spring of the third year of their growth. In this process it is of the utmost importance that the smaller and least healthy looking plants should be taken out, and those left which indicate the possession of a vigorous constitution, without regard to the mere circumstance of exact distances. When a plant has a robust stem, clear bark, and a plump leading bud, we may consider it as certain to produce a fine tree, or to contend with most success against natural defects of soil and climate, and accidental injuries. To protect young oaks against uncongenial climates, the best method is to plant nurse-trees of quick growth, and well adapted to the soil, amongst them. An artificial climate is thus produced, and to a certain extent, also, the soil is ameliorated by the roots of these nurse-trees running near its surface, while the oak has its roots obtaining nourishment from below; the former, acting as drains, assist the growth of the oak, until its own roots and stem have acquired sufficient strength and dimensions to resist with effect the various unfavourable circumstances above alluded to. In soils suitable to oak this is not always necessary; but deficiencies of soil and climate are generally remedied by the judicious planting of nurse-trees, of which we shall treat more particularly hereafter. The keeping down of the weeds, and the pulverizing of the soil by the hoe, being unweariedly attended to, the young trees will make rapid progress, and will require to be thinned out to four or five feet on an average in the rows, in the fifth year from sowing, when they will have reached that period at which the opposite and more general practice, that of transplanting from seed beds to the timber sites, begins; and as the subsequent culture, pruning and thinning, is the same in both instances, to be treated of separately, we shall proceed to consider the rearing of forest trees by transplanting. No greater error exists in the planter's art than the doctrine that trees should be raised on the same quality of soil as that to which they are to be transplanted,—as if a robust, healthy plant were less likely to withstand its subsequent casualties of situation, soil, and local climate, than a weaker plant with contracted sap vessels—the invariable consequence of a poor seed-bed soil. What is the intention of all the various processes of culture which have been just described as essentially necessary to the raising of oak from the acorn on a damp, cold, clayey soil, but to *enrich* the soil, and render the seedling plants vigorous and healthy? and with how much less labour and expense can this be effected in a nursery bed of clean fresh soil, of whatever nature or texture, than on the extensive site of an intended plantation of forest trees?

Experience fully confirms that principle of vegetable physiology which teaches that robust, healthy plants, whether in the seedling stage of grnwth or of a larger size, succeed better than thuse of stinted growth, even when transplanted to the least favourable soil and exposure.*

Where the land to be planted with forest-trees is an extensive tract and remotely situated, and where the seeds of the several kinds can be procured genuine, of good quality, and at a small cost, the formation of a private nursery may be advisable; but where the plants can be procured from a reasonable distance, it will be found the most economical and effective to purchase them from the nurseryman, and even in the former case one or two years' seedlings should be procured in place of seeds, as a saving of time and expense. The following are essential points to be considered in establishing an effective nursery: fencing, shelter, aspect, soil, and management. The fence of a forest-tree nursery requires to be *rabbit-proof*, or loss and disappointment are almost certain to follow. A foundation of brick-work should be made for a superstructure of close paling. Where shelter is not an object, a very cheap and excellent substitute is found in iron wire-netting, which is manufactured for the general purposes of fences tn young plants. *Shelter* is indispensable to the free growth of seedling plants, the injurious consequences resulting to which from sudden checks have already been mentioned, as also the bad effects of confined air to the health and prosperity of trees in every stage of growth; and therefore, at the same time that a full protection against cold, bleak winds and unfavourable aspects is necessary, a full and free circulation of atmospheric air must be secured, to allow of a well-grounded hope of success.

The *soil* of the nursery must be of an intermediate quality as to moisture and dryness, not less than eighteen inches deep to the subsoil, and under a south, east, or west exposure, or intermediate points of these. The varieties of soil required for particular kinds of trees will have to be supplied where the natural soil is deficient, as has already been specified when speaking of the seeds of trees. (p. 13.)

Management.—This head comprehends an ample degree of practical skill in the superintendent and workmen; the erection of proper sheds, the means of carriage for composts, soils, plants, &c., immediately when needed. A quantity of compost and different soils should always be in readiness when wanted for the seedling beds, layer stools, and cutting beds, and a proper assortment of nursery garden tools, which shall be specified hereafter. The preparation of the soil, the mode of sowing, and the different kinds of forest-tree seeds, have already been described. All kiuds uf forest trees, however, are uot raised from seeds, either because

* It is difficult to give a definition of what is termed a *robust, healthy plant*, so as to apply to every species of tree wherein the habits of growth vary in every individual species. The points of excellence cannot be estimated statically, or by weight and measure, but comparatively. A number of minute discriminating characters, collectively, are readily distinguished by the eye, but when taken separately cannot be usefully described in words. A robust, healthy plant, not exceeding five years' growth, may be said to have equally divided roots, the principal ones uf moderate length well furnished with secondary rootlets, and these with numerous fibres; the stem straight, and possessing a girth or diameter proportionate to its length; the bark clean, with an epidermis on the young wood exhibiting fissures, as if bursting or giving way to the increasing size of the parenchyma, particularly in the season of spring or autumn; the buds full in size and not crowded; the leaves perfectly shaped, and of the natural colour. The opposite of this state, from the effects of a poor or ungenial soil, exhibits all these characteristics in a diminished form and number; the opposite extreme or unhealthy state of a plant, from the effects of over-richness of soil, may be supposed; for in our experience we have never met with an instance of the kind, to have all these parts of the structure in an enlarged excess.

they do not perfect a sufficient quantity for the general purposes of propagation, or are accidental varieties only of a species losing their characters of distinction when reproduced from seed. The following modes of propagation are found effectual when seeds cannot be obtained: first by *suckers*, second by *layers*, third by *cuttings*, and fourth by *grafting*.

1st. *Suckers* are shoots produced by the creeping roots of a tree, which, when separated from the parent root and transplanted, become perfect trees. They are generally sufficiently rooted in the first season of their production, and they should not be suffered to remain longer than two seasons attached to the root of the tree; for if continued longer, the support they derive from the parent root prevents them from making independent roots of their own in such abundance as they do when separated or taken up at an earlier period. The spring is the most proper season for taking them from the parent roots. When a sufficient number of rootlets appear on the sucker, no part of the root from whence the sucker sprang should be left attached to it; but where the proper rootlets are deficient in number, a small portion of the parent root may be left with advantage. The plants should be planted in rows in fresh soil, and treated in all respects afterwards as directed for seedling transplanted trees. The kinds of trees chiefly reared in this mode are:

The abele tree, *Populus alba.*
Common white poplar, *Populus canescens.*
Aspen, *Populus tremula.*
Chinese ailanthus, *Ailanthus glandulosa.*

The first three kinds may also be propagated by layers.

2nd. *Layers.*—The process of *layering* is well known: it consists in bending a young branch (*a*, *fig.* 2) into the soil to a certain depth, and elevating the top part of it out of the soil in an upright direction; in time the buried part takes root, and the shoot becomes a perfect plant. The root which produces the young shoots for layering is called the stool. Stools are planted about six feet apart every way in a deep fresh soil. The stem at first is either bent down into the ground as a layer, or cut over a few inches from the root. The shoots which are produced from its sides form the layers (*d*). The rooting of the layers is much facilitated by obstructing in part the descending sap; this is essential to some kinds of layers, though not to all: the common laurel, privet, &c., strike root readily without any artificial stoppage of the descending sap. The most expeditious mode of effecting this, is to cut a notch, slanting upwards to the origin of the layer, about half a diameter in length (*f*), and securing the position of the layer in the ground by a wooden peg (*g*). Where the shoot is of a nature that roots with difficulty, it is useful to split the *tongue* of the notch half way up, and to insert a small wedge of potsherd or wood to keep the division open. Rings of wire are also sometimes used for the same purpose, and cutting the bark round the part to within a little of the complete circumference of the shoot. In all ordinary cases, however, the slit or notching mode is perfectly effective. The ground should be kept quite clean of weeds, and watered in dry weather. When sufficiently rooted, the layers should be carefully cut away from the shoots, with all the fibrous roots attached to them, and planted in rows in fresh, well-prepared soil. The stools should have all the stumps of the branches cut away, and left to produce a fresh

fig. 2.

series of shoots for next autumn's layering. The following trees are propagated by layers.

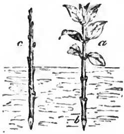
Maple, silver striped maple, *Acer campestre, fol. arg.*
Sir G. Wager's, *A. dasycarpum.*
bastard, *A. hybridum.*
lobe leaved, *A. lobatum.*
mountain, *A. montanum.*
ash leaved, *A. negundo.*
Italian, *A. opalus.*
striped barked, *A. Pennsylvanicum.*
cut leaved, *A. platanoides laciniatum.*
gold striped, *A. pseudoplatanus, fol. aur.*
silver striped, *A. pseudoplat. fol. arg.*
Tartarian, *A. Tartaricum.*
Montpellier, *A. monspessulanum.*
Alder, cut leaved, *Alnus laciniata.*
oak leaved, *Al. quercifolia.*
prickly leaved, *Al. glutinosa spinulosa.*
Turkey, *Al. oblongata.*
oval leaved, *Al. oblong. elliptica.*
Birch, daurian, *Betula daurica.*
Canada, *B. lenta.*
black, *B. nigra.*
paper, *B. papyracea*
poplar leaved, *B. populifolia.*
red, *B. rubra.*'
Hornbeam, cut leaved, *Carpinus bet. incisa.*
Judas tree, American white flowered, *Cercis silig. fl. alba.*
Date plum tree, *Diospyrus lotus.*
Spindle tree.
gold blotched, *Euonymus Europ. fol. aur.*
silver, *fol. arg.*
white, *fruc. alb.*
pale, *fruc. pal.**
Beech, broad leaved, *Fagus ferruginea.*
purple leaved, *F. sylvatica purpurea.*
copper leaved, *F. sylvatica cuprea.*†
Ash, weeping *Fraxinus pendula.*‡
curled leaved ash, *F. atra*
flowering ash, *F. ornus.*
manna ash, *F. rotundifolia.*
striped barked ash, *F. striata.*
Mulberry, white, *Morus alba.*
common, *M. nigra.*
Tufelo tree, *Nyssa aquatica.*
mountain, *N. montana.*
Bird cherry, *Prunus padus.*
Cornish, *P. pad. rubra.*
Buckthorn, sea, *Rhamnus catharticus.*
Lime tree, white, *Tilia alba.*
broad leaved, *T. Americana.*

* These four trees are of low growth, and only for ornament
† Propagated also by grafting.
‡ When grafted on the common or tall ash, the pendulous branches have a striking effect.

common, *T. Europæa.*
red twigged, *T. Europ. corallina.*
downy leaved, *T. pubescens.*
Elm, English, *U. campestris.*
striped leaved, *U. fol. var.*
Cornish, *U. sativa.*
hornbeam, leaved *U. nemoralis.*
Dutch, *U. suberosa.*

3rd. *Cuttings.*—Shoots of one year's growth are the most proper to be used in this mode of propagating several kinds of forest trees. The shoots should be selected from the most healthy and free-grown branches, and cut into lengths of from six to eighteen inches, according to the kind of tree. If evergreens (*a*, fig. 3), the leaves should be cut off half way up from the root-end of the cutting (*b*). Deciduous trees should have shed their leaves before the cuttings (c) are taken from them. The root-ends of the cuttings should be cut finely smooth, and inserted from about a half to three parts of their length into the soil. For every species of cutting, the soil should be light, and composed, at least, of half of fine siliceous sand. There are many species of exotic plants, whose cuttings will only strike root in pure siliceous sand. It need hardly be remarked, that in this mode of propagating, watering is more particularly required to be attended to than in any other. The utility of the sandy nature of the soil consists in its retaining no stagnant moisture, but just sufficient for the wants of the shoot during the process of rooting. As soon as the cuttings are well rooted, if in a light soil of the above description, they should be carefully taken up and transplanted to their proper soil; for although the shoots produce roots more quickly and in greater abundance in the siliceous sandy soil, yet it is unable to support the growth of the plant after the proper functions of the roots begin. Next to that of propagation by seeds, plants may be increased by cuttings more generally than by any other mode: the process, however, requires more time, skill, and attention, than is demanded for rearing trees from suckers, or by layers or grafting, and it is therefore chiefly practised for the increase of exotic ornamental plants; but the following forest trees are most advantageously raised from cuttings:

Fig. 3.



Plane, American, *Platanus occidentalis.*
Spanish var., *P. acerifolia.*
Oriental, *P. orientalis.*
waved leaved, *P. cuneata.*
Poplar, Carolina, *Populus Carolina*
Lombardy, *P. dilatata.*
Athenian, *P. Græca.*
Canadian, *P. monolifera.*
black, *P. nigra.*
weeping, *P. pendula.*
trembling, *P. tremula.*
Maiden-hair tree, *Salisburia adiantifolia.*
Willow tree, common, *Salix alba.*
Peach leaved, *Amygdalina.*

Duke of Bedford's, *Russelliana.*
weeping, *Babylonica.*
round leaved, *Capera.*
gray, *Cineria.*
crack, *Fragilis.*
spear leaved, *Hastata.*
common, *Helix.*
fine stemmed or smooth leaved, *pentandria.*
triandrous, *triandra.*
golden osier, *vitellina**.

4th. *Grafting*, in forest-tree propagation, is chiefly had recourse to for those varieties of trees which lose their distinctive characters when reproduced from seed, and which make finer trees when grafted on free growing stocks of their own species. The scions† take more freely when not more than of one year's growth, but those of much older growth will succeed. The most perfect grafting is where the scion and the part of the stock to which it is to be united are nearly of an equal size, for on the perfect contact of the inner bark of the scion and stock depend the perfect union of the two in the shortest space of time, and consequent equal healing of the wound. The month of March is the best season for forest-tree grafting. The modes of grafting are numerous. French authors enumerate upwards of forty; for the purposes now under consideration, however, that termed *whip* or *tongue* grafting is generally followed. The scions should be selected from the more upright, free-growing branches; the middle portion of the shoot is the best; but where there is a scarcity of grafts, the top and bottom may be used, as these will succeed, though not likely to produce such fine trees. From two to five buds should be left for the production of a leading stem and branches. The stock should be cut in an oblique direction (*a*, fig. 4), and the scion in like manner at a corresponding angle *(b)*; a slit should then be made in the stock about the middle of the wound, passing downwards (c), and a similar slit upwards in the scion (*d*); the upper division of the scion made by the slit, termed the *tongue* or *wedge*, is then inserted into the cleft of the stock, and the inner barks of the stock and scion brought into perfect contact, at least on one side. This should be effected with as little delay as possible. The parts are then to be bound with a riband of bass, and particular care should be taken that, in this part of the process, the junction of the two barks is not in the least displaced. To protect the grafted parts from drought and moisture, and from the action of the air, various means have been adopted, but the most direct and useful is well-worked clay, cleaned of gravel or small stones, and horse-droppings, well incorporated and mixed in the proportions of three parts of the former to one of the latter; a little finely-chopped straw is added with advantage. The clay should be

fig. 4.

* This numerous and highly interesting tribe of forest plants, from the useful and varied properties which the different species evidently possess, demand more of the notice of the forest planter than they have yet received. The extensive and important trials instituted by John Duke of Bedford, now in progress, to investigate the comparative merit of all the different species of willows, will afford much useful information on the subject.

† Scions may be separated from the parent stock some time before grafting, without suffering injury from being kept, but the root-ends should be placed in earth to prevent the bark from shrivelling. The ascent of the sap in the stock being more advanced in the stock than in the graft, is sometimes advantageous.

placed on the grafted parts an inch thick on every side, and extend about half an inch above and below the union of the stock with the graft*.

fig. 5.

Another mode, called *saddle grafting*, is perhaps better adapted for forest trees than the foregoing, but it takes up more time in the performance. The stock should be cut so as to leave the top in the form of a wedge (*a*, *fig.* 5); the scion split at the lower end, and each side of the incision pared obliquely, so as to form the two divisions into tongue-like processes (*b*); these are then seated on the wedge and made to fit accurately to each side of it. The after operations of tying and claying are the same as in the former mode. The trees which come under the forester's care that require to be reared by grafting are the following:

Broad-leaved evergreen oak, *Quercus ilex latifolia.*
entire leaved, *Q. ilex integrifolia.*
Lucomb's, *Q. Exoniensis.*
Turner's, *Q. Exoniensis Turneri.*
broad-leaved Lucomb's, *Q. Exoniensis latifolius.*
Sweet crab tree, *Pyrus coronaria.*
Siberian crab, *P. prunifolia.*
willow leaved, *P. salicifolia.*
Chinese, *P. spectabilis.*
wild service, *P. terminalis.*
white beam, *P. aria.*
Swedish white beam, *P. aria dentata.*
small fruited crab, *P. baccata.*
Heart-leaved poplar, *Populus candicans.*
various leaved, *P. heterophylla.*
smooth leaved, *P. heter. lævigata.*
Upright medlar, *Mespilus germanica.*
weeping medlar, *M. ger. diffusa.*
Entire leaved ash, *Fraxinus simplicifolia.*
striped barked, *F. striata.*
variegated, *F. variegata.*
white American, *F. Americanus.*
black, *F. Amer. pubescens.*
red, *F. Amer. rubrus.*
Gold striped beech, *Fagus sylvatica fol. aur.*
silver striped, *F. sylv. fol. arg.*
copper coloured, *F. sylv. cuprea.*
purple leaved, *F. sylv. purpurea.*
Gold striped Spanish chestnut, *Castanea vesca, fol. aur.*
silver, *C. ves. fol. arg.*
various leaved, *C. ves. heterophylla.*
shining leaved, *C. ves. lucida.*
Gold striped horse chestnut, *Æsculus hippocastanum, fol. aur.*
silver, *Æ. hipp. fol. arg.*
yellow horsechestnut, *Æ. flava.*
scarlet, *Æ. paria.*

* It is a highly useful practice to draw earth up round the clay so as to cover it entirely from the sun and air.

The stocks for these trees should be raised from seed of the common species, to which each variety is nearest allied, for the nearer the connection of the stock with the graft the more lasting is the union and more perfect the growth. In trees that have been grafted on unsuitable stocks, we frequently see the base of the stem abruptly contracted to a smaller circumference than the upper portion, and *vice versâ*, just as the stock or the graft happens to possess the freest habit of growth. The stocks should be planted in rows two feet apart, and should be one foot distant plant from plant. When arrived at two years of transplanted growth they will be in a fit state to graft. The grafts should be united to the stock as near to the root as convenient. This facilitates the vigorous growth of the tree, and allows of the earth being drawn up on each side to cover the *clayed* portion of the graft. The clay should be removed from the grafts, and the ties or bandages loosened when the progress of the new shoots of the graft indicates the perfect completion of the process. In the spring following that in which the trees were grafted, many of them may be transplanted to their permanent sites; but it is better, as a general rule, to defer transplanting until the second autumn or spring. The *size* of the different kinds of trees most suitable for final transplanting is a point of some importance, particularly when the planting is on a large scale, and where the preservation of every fibre of the roots of the plants cannot be accomplished without an unnecessary expense of time and labour. A very young plant may be readily taken up and transplanted with its roots entire; but a plant of several feet in height requires considerable care in taking it up to preserve its roots from injury. The structure and the functions of the roots of trees, as connected with the produce and support of the plant were before described, and clearly point out the essential use of the minute rootlets and their accompanying spongeols or glands to the nourishment of the plant in every stage of its growth, and under every change of circumstance. Accordingly we find that, if a plant is taken up and transplanted with all its roots entire and uninjured, it experiences scarcely any perceptible check, unless its roots are exposed to the effects of the sun and wind for any considerable time, in which case it makes little, if any progress for a season. A moderate degree of pruning, however, of the overgrown and straggling roots of young trees, possessing the reproductive power in a full degree, and of the branches of their stems, is often expedient, and, when judiciously performed, is beneficial: it prevents the accident of doubling up the roots, or improperly disposing them in the soil, an evil of worse consequences to the plant than the shortening of an overgrown root, or lateral branch. To trees which possess the reproductive power in a very imperfect degree, pruning the roots or branches preparatory to transplanting is injurious. The facility with which young plants of any kind can be taken up without hurting the roots, and the slight pruning which they require at that stage of growth, point out as a general rule in deciding on the most proper size of the different species of trees for final transplanting, that the non-reproductive kinds should be of the smallest size or earliest stage of growth, and those in which the reproductive power is greatest of the largest size. If we divide the stem of a Scotch fir, or a larch, a corresponding stem is not reproduced; but if we cut down, in like manner, a willow, or even a chestnut, or an oak, a vigorous stem will follow. Where the habit of the roots is to divide into large branches, and run deep into the ground, as in the case of the oak, younger plants are required for transplanting than in those instances where the habit of the root is to produce numerous fibres. The nature of the soil also dictates, in some measure, the size of

the plants. In rocky, elevated soils that cannot be ploughed or trenched, nor can allow of proper sized holes being made with the spade, plants of one or two years growth, or such as have small roots, can only be planted: when exposed to severe winds, plants above one foot in height are loosened in the soil, and never prosper. For the purposes of general or extensive works of forest planting, the best sizes of the plants of the different species of trees at the period of transplanting to their timber sites, may be thus enumerated:

1st. NON-REPRODUCTIVE OR RESINOUS TREES.	Height.	
Pinus *abies*, common spruce fir, from	6	to 20 inches.
alba, white spruce.		
rubra, red spruce.		
nigra, black spruce.		
sylvestris, Scotch fir.		
laricis, Corsican fir		24
uncinata, hooked fir		18
pumila, upright coned fir		12
Mughus, nodding coned fir.		
pungens, prickly coned fir.		
Banksiana, Hudson's Bay fir, in pots*		24
Pallasiana, Prof. Pallas's fir.		
pinaster, cluster fir	6	20
pinea, stone pine	6	18
maritima, sea-side pine	6	18
Halepensis, Aleppo pine	6	18
inops, Jersey pine	6	18
resinosa, pitch pine	6	18
variabilis, various leaved pine.		
Clanbrassiliana, dwarf pine.		
tæda, frankincense pine, in pots.		
serotina, fox-tail pine.		
rigida, three-leaved pine	6	20
palustris, swamp pine, in pots.		
longifolia, long leaved pine.		
Cembra, Siberian pine	6	18
strobus, Weymouth	12	36
excelsa, Bhotan, in pots.		
cedrus, Cedar of Lebanon, in pots.		
deodara, Indian cedar.		
pendula, black larch.	6	24
microcorpa, red larch.		
larix, common larch.		
Canadensis, hemlock spruce	9	20
dumosa, bushy pine, in pots.		
taxifolia, yew leaved, in pots.		
picea, silver fir	9	20
spectabilis, purple coned, in pots.		
balsamea, balm of Gilead	9	20
Fraseri, double balsam, in pots.		
adunca, crooked.		
Romana, Roman.		

* By this is meant such sorts of forest-trees as from their rarity, or recent introduction of very small quantities of their seeds, have rendered the utmost care and caution necessary in the first attempt to cultivate them here; by and by, instead of being raised in pots, the seeds may be found to succeed equally well in the open ground.

		Height.
Pinus *Siberica*, Siberian pine	. . .	9 to 20 inches.
pichta, pigmy pine, in pots.		
orientalis, nriental pine.		
Lambertiana, Lambert's pine, in pots.		
ponderosa, heavy wooded.		
Araucaria *imbricata*, Chili pine.		
Taxodium *distichum*, deciduous cypress.		
Cupressus *sempervirens*, upright evergreen cypress.		
thyoides, white cedar.		
Juniperus *Virginiana*, red cedar.		
Thuja *occidentalis*, American arbor-vitæ.		
orientalis, Chinese.		
plicata, Nee's.		
Caroliniana, Lucas's arbor-vitæ.		

2d. Reproductive trees.

	Height.	
Quercus, oak, different species of . from	6 to	30 inches.
Fraxinus, ash, different speeies of	6	20
Castana, Spanish chestnut	12	30
Æsculus, horse chestnut	12	30
Fagus, beech	6	20
Betula, birch	9	30
Alnus, alder	6	24
Carpinus, hornbeam	6	24
Platanus, plane	12	30
Acer, sycamore	6	30
Maple common	6	24
Norway	6	24
Grafted and layer reared species	12	36
Tilia, lime, common, and others	12	36
Ulmus, elm, wych	9	30
Grafted and layer reared species	18	36
Populus, poplar, different speeies of	18	36
Salix, willow tree, species of.		

Those speciea which are mentioned as raised in pots for transplanting, except the cedars and a few others, are as yet considered merely ornamental trees, the period of their introduction not having allowed sufficient time to prove their properties or comparative value as timber trees. It is highly desirable to plant them, with a view to ascertain that point, several of them being highly valuable in their native countries. The pinus Lambertiana has been fnund to have attained to the growth of 200 feet in height, and 57 feet in circumference*.

Modes of transplanting. Much difference of opinion prevails on the comparative merits of the different methods of planting from time to time introduced, and more or less practised. Trenching is held by some to be essential to success, without considering that there are situations and soils where timber of the most valuable quality may be produced that cannot be dug or trenched. Others again infer, that to insert seedling plants into the soil in its natural state is all that is required for the production of timber and underwood possessing every requisite value.

These opinions are too exclusive; they have led to baneful effects, and still are the cause why many extensive tracts of land lie waste, which otherwise might have been covered with profitable plantations. But in more

* Transactions of the Linnean Society of London, vol. xv. Part II. p. 498.

numerous instances, from the same cause, great and unnecessary expenses have been incurred, only to result in a total failure of the plantation, with the consequent loss of time and property. Instances illustrative of these points have been too frequent in the management of the forest lands of the Crown, (which ought to shew an example of practical planting worthy of imitation by the community,) as well as on private estates, to require to be cited here. Well regulated economy in the expense, or first outlay, is one of the principles of the art important to be attended to in practice. Accordingly it is not surprising to find some modes of planting invented, and others misapplied, under the mistaken impression of furthering this principle, at the serious risk of retarding the healthy growth and prosperity of the trees, and of producing results completely subversive of the intention.

The great object of transplanting trees from seed-beds, layer-stools, cutting grounds, &c. to nursery rows, or beds previous to their final transplantation for good, is to increase the number of fibres and rootlets; and, by ensuring the free uninterrupted formation of healthy stems and buds, to lay the foundation of a vigorous constitution in each individual plant before it be finally transplanted to its timber site.

The different modes of planting trees on their timber sites are denominated, first, slit-planting; second, holing or pitting; third, trench-planting; fourth, furrow-planting. There are also varieties of these characterised by the instruments or tools used for inserting the roots of the plants into the soil.

Slit planting is the most simple mode, and is practised on soils in their natural state without any preparation of holing, ploughing, or trenching. It is performed by three different kinds of instruments: viz. by the *moor planter* (*fig.* 6. *a*), by the diamond dibble (*b*), and by the common garden spade.

Fig. 6.

1st. The *moor planter* (*a*) is a heavy instrument, consisting of a wooden shaft and handle two feet nine inches in length, terminated by a single slightly curved prong of well tempered iron or steel fifteen inches in length, two and a half inches broad at the insertion of the shaft, and gradually tapering to the point. The handle is made sufficiently large to be grasped by both hands, and the operator with one stroke drives the prong into the ground to the depth required for seedling trees, and by depressing the handle, the point of the instrument raises up the earth, leaving a vacuity or opening in loose earth, into which a person, holding a plant in readiness, places the root, and with the foot fixes it in the soil. A stout active workman with this instrument, and the aid of a boy, will transplant a greater number of seedling trees on light moor soils than by any other method at present known.

2d. The *diamond dibble* (*b*) is recommended by Sang*: it is made of a

* Planter's Kalendar, p. 170.

triangular shaped plate of steel, furnished with an iron shaft and wooden handle. The sides are each four inches long, and the upper part or side four inches and a half broad. It is used for planting on sandy and gravelly soils where the surface produce of herbage is short. In this case the planter makes the ground ready with the instrument in one hand, and inserts the plant with the other. He carries the plants in a bag or basket suspended from his waist; he strikes the dibble into the ground in a slanting direction so as to direct the point inwards, and, by drawing the handle towards himself, an opening is made, and kept open by the steel plate for the reception of the roots of the plant by the other hand. The instrument is then removed, and the earth made firm about the roots of the plant by a stroke with the heel of the instrument.

3d. By the *spade*, a cut is made in the turf with the spade and crossed by another at a right angle: the two cuts thus made resemble the figure of the letter T. The handle of the spade being depressed backwards forces open the edges of the cuts, and in the opening thus made the roots of the plant are inserted; the spade is then withdrawn, and the turf replaced by pressure with the foot.

Sir John Sinclair describes an improved mode of slit-planting, as follows: The operator with his spade makes three cuts, twelve or fifteen inches long, crossing each other in the centre, at an angle of sixty degrees, the whole having the form of a star. He inserts his spade across one of the rays (*a*), a few inches from the centre, and on the side next himself; then bending the handle towards himself and almost to the ground, the earth opening in fissures from the centre in the direction of the cuts that had been made, he, at the same instant, inserts his plant at the point where the spade intersected the ray (*a*), pushing it forward to the centre, and assisting the roots in rambling through the fissures. He then lets down the earth by removing his spade, having compressed it into a compact state with his heel; the operation is finished by adding a little earth with the grass side down, completely covering the fissures, for the purpose of retaining the moisture at the root, and likewise as a top dressing, which greatly encourages the plant to push fresh roots between the swards*.

Fig. 7.

a

4th. The defects of the slit mode of planting are, that the earth is not properly reduced in its texture to suit the tender fibres of the roots of seedling plants, and the natural plants of the surface are left to contend with them for the nourishment afforded by the soil, nor can the rootlets of the young trees be disposed and placed in their right positions. The least objectionable practice is to cut a circular piece of the turf, a foot in diameter, and lay it on one side with the surface downwards; the workman then with his spade loosens and breaks down the texture of the uncovered soil, and, by making ample space for the extension of the roots of his plant in every direction, inserts it in the pulverized earth. The turf which had been reversed and laid on one side, is then with a stroke of the spade divided into two equal parts, and replaced on each side of the plant in its reversed position. The reversed turf supports the plant against the effects of the wind, retains the proper moisture of the soil, and prevents the evil consequences resulting to the lateral branches of the young tree, and to the healthy progress of the stem, from the uncontrolled growth of the herbage natural to the soil,—all of which, by the former modes, are rather encouraged than checked. In uninclosed commons or moors, the natural

* General Report of Scotland, vol. ii. p. 283.

herbage and shrubby plants are kept under by cattle, &c.; but when such lands are inclosed for planting, and thereby protected from stock, the natural plants, which before appeared diminutive and slow of growth, suddenly attain a size and vigorous vegetation highly detrimental to the young forest trees.

2. *Mattock* planting is confined chiefly to rocky ground, and to soils containing many coarse, tough roots of herbage, heath, &c.; and under these circumstances the mattock is an indispensable instrument. It is thus described in the Planter's Kalendar:—'The handle is three feet six inches long; the mouth is five inches broad, and is made sharp; the length of it to the eye or shaft is sixteen inches, the small end or pick is seventeen inches long' (*c*, fig. 6). It may be unnecessary to mention that the broad or hoe end should be faced with steel and kept well sharpened; it is perfectly effective in cutting or paring the heath, furze, &c., and the pick end is equally so for thoroughly loosening and fitting the soil to be operated upon with the spade or *planter* (*d*). The *Hackle* prongs are recommended for clayey, tenacious soils*, which are difficult to work with the spade. It is made with two or three prongs; the former of two for the soil just mentioned, and the latter of three prongs for stony or gravelly soils.

3. *Holing.*—Holes or pits are dug out, and the loosened soil left for a season to the action of the weather, to ameliorate and reduce its texture. Time should be afforded for the rotting or decomposition of the turf or surface produce taken off the space which is opened, previous to the period of planting. The size of the holes should vary according to the size of the plants to be planted, and to the nature of the subsoil. Plants from one and a half to two feet high should have the holes two feet wide and eighteen inches deep, prepared in the summer or autumn for the reception of the plants in spring. For trees of larger growth, the extent of the roots must determine the size of the holes, making an allowance of from six inches to a foot of extra width beyond the extreme points of the roots. Holes made in tenacious clays retain the water which falls into them, and rots the roots of the trees; dry, light, sandy soils cannot be benefited by the pulverizing action of the sun and air; rocky soils admit but imperfectly of holing; and some kinds of binding gravelly soils are as liable to the retention of moisture as stiff clays. The practice of holing is therefore never attended with success on these kinds of soil.

Spade planting applies to land prepared for the reception of the plants by trenching. Although this mode of planting is the most common in use, and may appear to require but little exercise of skill on the part of the operator, it is nevertheless often very badly executed. It is best performed when the holes are made a few inches wider than the roots of the plant extend; the earth of the bottom of the hole should be broken down with the spade, the sides all round should be made to slope inwards, so as to cause the bottom to be wider than the top. The person who holds the plant should then place it in the centre of the pit, and the operator with the spade should have ready some fine surface soil to cover the bottom and raise it up to the proper height, the person holding the plant raising it at the same time, so that it may stand not deeper in the soil than it previously stood. The earth should then be carefully thrown in a finely divided state, and the plant during the operation slightly moved, so as to prevent the roots from being covered in bundles, and to afford each root and rootlet to have a portion of soil intervening between it and the rest.

* Pontey's Profitable Planter.

Treading should be avoided, as it renders the soil cohesive, which in stiff or heavy land is an evil of great magnitude to newly-planted roots. In light soils, however, a slight pressure with the foot to keep the plant steady in its place is necessary, particularly if the weather is dry during the season of planting; but in cases where it is practicable, it is much more beneficial to *settle* the earth about the roots of the plants by a free application of water in the usual manner.

It is the best and most expeditious practice to have one set of men to make the holes, and another to finish the planting. When different species of trees are to be mixed in the plantation, and in unequal proportions, each species is successively distributed and planted. What we have already stated respecting the great importance to the success of the plants of not suffering the roots to be dried by exposure to the sun or wind, may render it unnecessary to urge here, that the distribution of the plants on the ground should not be farther in advance than just to keep the planters fully employed. Before laying the plants out on the spots where they are to be planted, it is a most useful practice to dip the roots in water, or in a puddle made of water and rich mould. In planting on a confined scale, the plants may be distributed as before, and two workmen may proceed to open the pits on the spots. As soon as the hole is opened, one of the operators places the roots of the plant in the hole, while the other with his spade finishes the process as above directed. By this method the holes can be made proportionate to the size of the roots of the different plants, which, when of various species, are oftentimes also of different sizes. When circumstances warrant the previous preparation of the soil necessary to this mode of planting, it should be adopted, as being the most perfect and effective.

Furrow planting is performed by opening a furrow with the trenching plough, or with two common ploughs; the one succeeding the other in the same trench or furrow, and opening it to the depth required by the roots of the trees. The roots being placed in the furrow at the proper distances, the workman with the spade finds no difficulty in obtaining the necessary quantity of pulverized soil to complete the work. This mode of planting has been practised with success on the Duke of Bedford's estates in Bedfordshire, and in Buckinghamshire in the neighbourhood of Woburn. The implement employed was a very strong plough, drawn by six horses, and opening a furrow from twelve to sixteen inches deep, turning the sward or heath over on each side. This was followed by a scuffler or grubber of three tines, which completely stirred and pulverized the soil. On light land eight acres a day was done in this way, but the soil must be light and free from large stones or other obstructions.

That extensive and valuable plantations have been made by *slit* planting there are abundant proofs, and on elevated, thin, light soils incumbent on rock, or where trenching cannot be effected or the furrow plough be used, this mode may be adopted with economy and success. Before planting by this method, however, it is essential to know the precise nature of the subsoil, and that there does not exist a hardened stratum, impervious to water, beneath the surface, which frequently happens in heaths, or siliceous sandy moor lands, it generally consists of the heath-soil in a compact layer about an inch thick, containing a large proportion of oxide of iron, and impervious to water. Beneath, and next to this, is generally grey or white sand, surcharged with water; and whenever trees are planted, by the slit mode, on soils so constituted, they never make any healthy growth, but perish so soon as the roots reach the hardened stratum: trenching, or the furrow plough must be employed in such cases to destroy the impervious

stratum, and render free the circulation of water and air, otherwise the attempt to establish trees will be vain. When the land is clean, friable, moderately deep, free from, and not retentive of stagnant moisture, the mode of planting by holing may be adopted with propriety. Lands of a tenacious, clayey nature, and also those of the best quality, employed for forest planting, ought to be trenched, as being the most economical ultimately, and the most effectual, for these kinds of soil. The preparation of tenacious clayey soils by paring, and burning, and trenching, has already been stated.

Since the above was prepared for the press, we have perused the able tracts * on planting by W. Withers, Esq., of Holt, in Norfolk. This gentleman, besides shewing, by facts not to be doubted, the superior advantages of trenching, compared to that of holing or slit planting, in the more speedy returns of profits from thinnings, and extra annual increase of timber in the trees left for that purpose, has likewise proved the value of manure to *poor* soils in conjunction with this mode of preparation. That such a mode of preparation with the application of manure should be highly advantageous for the growth of the more valuable timber trees on soils of the nature now alluded to, will be instantly seen by every one who has examined carefully the natural habits of these trees by the principles of vegetable physiology already discussed; and such as may feel reluctant, or have not leisure, to employ this mode of arriving at a perfect conviction, may be amply convinced by comparing that soil on which the oak, for instance, or any other of the more valuable timber trees, invariably attains the highest perfection, with that on which it or they are always inferior. Compare the constitution of the soil No. 2, at page 7, with that of the soil No. 5, and the almost total absence of clay, chalk, and vegetable matter, will be evident in the former. Now, on this soil the oak, according to our experience and observation, is never found in a natural state, and, when planted in it, never attains to any value as a timber tree even with the aid, as nurses, of the pine, birch, and sycamore, which here succeed. On the soil No. 5, where the constituents of the soil are different from those of No. 2, the oak attains to the highest perfection. To supply manure, therefore, composed of clay (burnt or recent), chalk, and vegetable matter, or rotten dung, in the requisite proportions, and by deep trenching (remedying, in some measure, the defects of the subsoil), and by combining and comminuting the whole as intimately as possible, the soil No. 2 would approximate to that of No. 5, and the oak might then be planted with a certainty of its successful produce of timber. Any smaller application than the requisite quantities of these ingredients will, of course, give a diminished result as to the crop of timber, but still it will give an increase in proportion to the quantity applied.

The principle on which manure is objected to for the rearing of forest-trees, is, that it will force the growth of the tree beyond its natural state, and render the deposit of vegetable fibre soft, and of diminished strength and durability. This, however, is carrying the point to an extreme to which it is never likely to be in the power of any planter to arrive, were he even willing to attempt it. To manure a poor soil, for it should be here kept in view that this and not a rich, or even moderately rich soil, is intended, can have but one effect, and that is to improve the growth of the trees. But the great, immediate, and important object of manure here, is to furnish a liberal supply of food while the plant is in its first stages of growth, thereby giving it the means to form a strong constitution, enlarg-

* 'A Memoir on the Rearing, &c., of Forest-trees.' 'A Letter to Sir Walter Scott, Bart., &c.' 'A Letter to Sir H. Steuart, Bart., &c.' By W. Withers, of Holt, Norfolk.

ing its number of roots and rootlets, and, at the same time, improving the quality of the exhalations from the soil, for absorption by the leaves, which is, in fact, an amelioration of the local climate or air. All these important points to the health of the tree, to the value of its timber, and to the attainment of the object in view, a valuable return in the shortest space of time for the capital expended, are thus highly promoted, and, in a great measure, secured by trenching, manuring, and keeping clean of weeds or surface culture for a limited period after planting. As an answer to the important question, will the sum expended in trenching and manuring be returned with interest and profit in proportion to those of the lesser sum required for planting on unprepared land, Mr. Withers has brought forward facts and observations to which we shall revert when discussing the subject of the valuation of timber trees.

The proper distances at which young forest trees should he planted on their timber sites depends on the natural habits of growth of the different species, the nature and preparation of the soil, and the size of the plants to be planted.

The larch, spruce, and pine require less space than the oak, chestnut, elm, &c. The nature of the soil will determine the peculiar species of trees which should predominate in the plantation, and point out the distances at which they should be placed. If the soil is thin and of a light texture, the fir tribe should occupy the largest proportion, if not the whole space of land; if clayey, the oak, elm, ash, &c., should be the principal trees in the design; and, if a deep sandy soil, or if the soil be calcareous, elevated land, the beech, hornbeam, &c., ought to have the preference—all with the view to the ultimate produce of timber. The following table may be useful for readily pointing out the number of trees required for a statute acre of land, when planted at any of the undermentioned distances:—

Distance apart.	Number of Plants.	Distance apart.	Number of Plants.
1 foot	43,560	10 feet	435
1½ "	19,360	11 "	360
2 "	10,890	12 "	302
2½ "	6,969	13 "	257
3 "	4,840	14 "	222
3½ "	3,556	15 "	193
4 "	2,722	16 "	170
4½ "	2,232	17 "	150
5 "	1,742	18 "	134
6 "	1,210	19 "	122
7 "	889	20 "	108
8 "	680	25 "	69
9 "	537	30 "	49

In profitable forest-tree planting, the nearest distance at which young trees should be planted on their timber sites, is a yard, or three feet, and the widest space five feet; the medium distance of four feet plant from plant is, or ought to be, that most generally adopted. Seedlings of three years' growth, or plants which have remained two years in the seed-bed and one year in transplanted nursery rows, should be planted on their timber sites three feet apart every way, it being understood at the same time that the soil is thin, light, or sandy, and that the slit or holing in method of planting is used. But should the soil have been prepared by ploughing and trenching, and be in a clean fallow state, the medium distance of four feet, or three and a half feet, if the species of trees to be planted are exclusively of the fir or pine tribe, will be the most proper. Trees of the age now alluded to will vary in size from nine to twenty inches in height, exclusive of some species of poplar, elm, &c., which grow faster than the generality of forest trees. In well-prepared lan dof a deeper surface

soil than the above, plants from eighteen to twenty-four inches in height of the fir tribes may be planted with advantage; and deciduous trees, as the oak, chestnut, elm, &c., from three to four feet in height, may be planted at the distance of five feet apart. In the last case a return of profits from thinnings will be obtained at least two years earlier than from transplanted seedlings, under the like circumstances of soil. Trees planted as nurses for assisting the progress of those intended for timber are of quick growth, and in the course of from seven to twelve years will have attained to a size fit for the purposes of fencing, or to be used as poles, coopers' ware, &c., according to local demand. When the nurse trees have arrived at this stage of growth, they will require to be partially thinned, to make room for the timber trees, or *principals* of the plantation, as they are termed. Whenever the branches of the former interfere with those of the latter, no time should be lost in remedying the evil, by pruning the nurse trees, or cutting them down. If the different operations of planting have been judiciously performed, the value of the trees thinned out at this period will cover the rent of the land, with compound interest on the capital expended in planting it. Hence the importance of nurse trees, and the propriety of furnishing the ground at first with a sufficient number of young plants to be cut down and taken away periodically, until the principal timber trees have attained to maturity. In poor soils, where the original outlay of capital and the rent of the land are both small, the expenditure will be covered by the periodical crop of thinnings, and *vice versa* in better soils, authorizing a larger expenditure in the preparation, in the size of the plants, and in the mode of planting, a comparatively superior number of trees of increased value will be produced at each periodical thinning. These results are certain to follow judicious planting.

The third and last mode of rearing forest trees proposed to be discussed at the head of this chapter, is that of selecting the superior shoots of coppice stools, and training them to full-grown timber trees. The oak, on account of the value of its bark, is more frequently reared in this way than the elm*, ash, and chestnut. The timber of coppice trees is in general faulty, and of inferior quality to that reared from seeds. Where care, however, is taken in the selection of the shoots from healthy and not over-aged coppice stools, timber of the best quality may be obtained from them.

The produce of coppice stools consists of materials for fence wood, fuel, besoms, &c. Poles and bark are the most valuable of this produce, where the practice is to leave no standards, or saplings for timber. It is, however, perfectly clear, that when a wood or coppice offers to the purchaser produce of various sizes convertible to various uses, along with full-grown timber for navy purposes, the sale is more readily effected, and generally on better terms, than when the produce consists of smaller wood only. In making choice of the shoots of coppice stools to be trained for timber trees, great care should be had to select none but such as are straight and vigorous, and which originate as near to the roots of the stool as possible. The neglect of this latter circumstance is the chief cause of the unsoundness of coppice-reared timber, particularly at the root or *butt* end of the bole. The *parent wood* of coppice stools is most frequently suffered to rise too high from the roots, consequently the shoots emitted from it never grow with so much vigour, or attain to so great a size in a given space of

* *A great part of the elms (ulmus campestris) reared in Devonshire are from layers, and frequently defective at the most valuable part.—Vide Vancouver's Survey of Devon.*

One or two fertile tracts in Devon, where the soil is of the nature termed red sandstone, is more favourable to the growth of the elm than to any other tree.—*Mr. Kingston.*

time, as when the stool is kept within an inch or two of the surface of the ground. When the parent stool is a foot or more in height from the root, it becomes divided into pointed rugged parts, and if a tiller or shoot, left for a tree, is situated near to one or other of these, the *stub* is in time encompassed by the bark of the young tree wholly or partially, which causes blemish and unsoundness in the timber, as well as obstruction to its prosperous growth. The stumps of coppice stools should, therefore, be cut near to the surface of the ground, and the face of the *stubs* as level and free from fractures as can be. The kinds of trees most profitable for coppice produce are those which possess the reproductive power in the highest degree; these were before enumerated at page 34. It may be unnecessary here to observe that the non-reproductive trees, such as all the pine and fir tribes, are unfit for the purposes of coppice. The shoot, or tiller, being selected with due attention to these essential points, all other shoots belonging to the parent stool should be cut away close to the root. The young tree should then receive the same treatment as other trees reared by seed or transplanting. Although, under any circumstances, it cannot be recommended to convert a coppice wood into a timber grove, nevertheless, should the circumstance of local demand for timber trees be considerable, it is a highly profitable practice to allow a certain number of the most select oak tillers to remain for timber. Should the number finally left to become timber trees not exceed thirty on the space of an acre, the coppice produce will not receive any injury to be put in competition with the value of the trees retained. Were one hundred select tillers left on the cutting or fall of a coppice, and were the periodical falls made at eighteen years intervals of time, on the second cutting these tillers would be thirty-six years old, and worth from 10*s.* to 12*s.* each. At this period of growth twenty-five of the number should be taken away, leaving an average distance between those that remain of about twenty-four feet. At the next fall the trees will have attained to fifty-six years' growth, and will afford seventeen trees to be thinned out, of the value of 22*s.* each. At seventy-two years' growth the value will be increased to 38*s.* each tree, and allowing fifteen trees to be thinned out. At the fourth, or last thinning, the trees will be ninety years of growth, and worth at least 50*s.* each, leaving thirty timber trees, of which a part will be fit for ship-building, and exceed in value the fee-simple of the land. Land requiring a period of eighteen years to produce coppice-wood fit for cutting or a fall, cannot be worth more yearly than 10*s.* per acre in husbandry; consequently the rent of the land and cost of culture of the coppice is covered by these thinnings of the timber trees, leaving periodically the proper coppice produce, and at the termination of one hundred years the valuable trees above mentioned as clear profit.

The age at which coppices should be cut down varies according to the soil and their quickness of growth. Nine years may be considered the shortest period, and thirty years the longest, as oak-bark, which constitutes a valuable part of the produce, does not improve in quality after that age. Eighteen years' growth is about an average period for coppice-wood, and the average returns from bark and wood 21*l.* an acre*.

The comparative merits of the three different modes of rearing forest trees, proposed to be considered at the head of this chapter, will have appeared, from the facts brought forward, to be greatly in favour of transplanting young trees of proper sizes and age, from nursery beds to their timber sites, whether in regard to economy in the first and subse-

* There are instances of coppices affording returns of 50*l.* sterling profit per acre.

quent outlay of capital, in making and rearing the plantation, or in respect to the quantity and quality of timber produced on a given space of land, and in a given space of time. The rearing of oak timber from seed on the spots where the trees are to remain for timber is, however, an exception to the above conclusion under the following restrictions; namely, that the acorns of the best variety of oak (*Quercus robur vel longipedunculata*) can be obtained of good quality, at a reasonable cost, in sufficient quantities; that the land to be sown is in a perfectly clean state of culture, in *good heart* on the surface, and free from stagnant moisture; that labour is cheap; and that ample and complete protection from the attacks of vermin can be ensured to the acorns, and to the seedling plants till they equal in size three years' old nursery plants. When all these circumstances can be combined, then the mode of rearing the oak on its timber site from seed should be adopted, but not otherwise, or disappointment will be certain to follow.

Simple plantations consist of one or two species of trees only; *mixed plantations* of many different species. The latter, on suitable soils, are the most profitable; they afford an earlier, more permanent, and a larger return for capital than simple plantations. The judicious arrangement of the different forest trees, not only promotes the greatest returns of profit from the plantations, but likewise effects the highest embellishment to the estate and surrounding country*.

Shelter in winter and *shade* in summer are also important points. Evergreen trees, and such deciduous ones as retain their leaves to a later period of the year (the hornbeam, beech, and some varieties of the oak) afford much greater shelter in winter and in early spring, when it is most wanted, than those which lose their leaves early in autumn, and should, therefore, be planted wherever shelter is most desired. Shade is best afforded by trees which, rising with naked stems to a certain height, afterwards send out an extended series of branches, as the oak, beech, chestnut, and elm, which can be readily trained to that state by pruning, and their spreading branches and umbrageous foliage are highly superior for this intention than those of the ash, sycamore, plane, &c.

Although mixed planting, as just now observed, is the most profitable, and, under skilful massing and grouping, the most embellishing to the landscape, yet there are certain circumstances connected with the growth of the various species of forest-trees, which, when they occur, effectually control the choice of the planter in his modes of arrangement: these are, first, the peculiar nature of the soil to be planted; secondly, the climate, or the exposure and elevation of the site of the plantation. In planting, soils may be divided into *simple* and *mixed*. The latter allows of the fullest scope to mixed planting. *Simple* soils are those which contain the smallest number of ingredients in their composition, or which consist chiefly of one substance; as sandy soils, containing from nine-tenths of

* Planting the same sort of trees in masses was originally practised at Blair Adam, e. g. Half an acre of oaks, half an acre of beeches, half an acre of elms, half an acre of Spanish chestnuts, &c. This was altered for a mixture of different forest-trees, but Lord Chief Commissioner Adam has resorted recently to the original practice, especially on the sides of hills. His reason for this is, that mixing trees of different sorts (their growths being unequal) leads in thinning to sparing the more forward tree, though the tree of less value: whereas, uniting the same species of tree in masses, insured their growing pretty nearly in an equal degree, so that the choice in thinning secured the preservation of the best growing tree; and with regard to the effect of embellishment, the large masses of different colours, especially on the slope of a hill, appears to have more effect in point of grandeur than intermixture, the latter being more adapted to pleasure-grounds and the woodlands near a residence.

sand (the maximum at which the successful culture of the white field-turnip is supposed to be limited) to one-twentieth, the supposed point of absolute sterility for even common herbage, are properly termed simple sandy soils, and on which the pine, fir, larch, and perhaps the birch, can only be planted. Soils consisting of from seven-eighths to a larger proportion of chalk will rear the beech chiefly; and when the proportion of one-half of vegetable matter to one-half of sand and loam meet in a soil, it is properly simple vegetable earth, and comes under the denomination of peat, of which there are several kinds, but which will be more particularly mentioned under the head of soils. On this last-mentioned soil the planter is chiefly confined to the abele, poplar, and alder: the willow and birch only partially succeed, or when the vegetable matter is in a less proportion to the other ingredients above stated.

The elevation of the site of the intended plantation above the level of the sea, where that is considerable, influences the local climate so much as often to confine the choice of the planter to one or two species of trees only, even though the soil should be otherwise favourable for mixed planting.

It is calculated that an elevation of six hundred feet diminishes the temperature of a site equal to that of one degree of north latitude; the degree of dryness or humidity of the atmosphere, and the force of the winds seem also to increase in proportion to the elevation of the land. Accordingly we find that different species of trees occupy different regions and degrees of elevation on the mountains of the torrid, temperate, and frigid zones.

According to Humboldt, the trees which grow in the highest elevation are the pine and the birch, (these also it may be observed will flourish in the lowest situations, the birch in particular will grow in soils periodically overflowed or covered with water for two or three months in a year). The highest altitude of the growth of the pine is stated to be from twelve thousand to fifteen thousand feet above the level of the sea, in latitude 20°; and the limits of the growth of the oak appears to be confined to ten thousand three hundred. The last species of trees found nearest to the limits of perpetual snow on Mount Caucasus, in latitude 42½°, and on the Pyrenees, are the common birch (*Betula alba*), and the hooked pine (*Pinus uncinata*), and the red spruce fir (*Pinus rubra*). On the Alps, latitude from 45° to 46°, the common spruce appears limited to an elevation of about five thousand nine hundred feet. In Lapland the birch is found at the altitude of one thousand six hundred feet in latitude 67° and 70°.

The influence of different altitudes on the distribution and growth of forest trees, is evident even in the inferior elevations of the forests of Britain. The pine, fir, and birch occupy the highest points*; next the sycamore and mountain elm; lastly, the oak, beech, poplar, ash, and chestnut. When the ground to be planted is, therefore, so high above the level of the sea, as to influence materially the nature of the climate, the forest trees to be planted should be selected according to the above principles. In practice this may be termed *region planting*. By imitating the natural process in this respect, not only the most profitable returns which the site and soil are capable of producing will be secured, but also the most ornamental effects produced on the landscape, and the useful ones of judicious shelter obtained. It generally happens in extensive planting that the soil varies in different parts of the site in its properties and fitness

* *The Mountain ash occupies some of the most exposed of the Dartmoor Fens.—Mr. Kingston.*

to rear one species of tree better than another. When these different soils are, therefore, planted with the different trees best adapted to each, masses of diversified outline will adorn the landscape, having all the effect of a tasteful design, and the trees will be individually of the most healthy growth, a point of the last importance in ornamental effect.

Experience proves that, for elevated situations, the Scotch fir, *Pinus sylvestris*, the Norway spruce, *Pinus abies*, the larch, *Pinus larix*, the hooked pine, *Pinus uncinatus*, the birch, *Betula alba*, the sycamore, *Acer pseudo-platanus*, and the mountain ash, *Pyrus aucuparia*, are the most profitable: these, with the silver fir, *Pinus picea*, black Italian poplar, *Populus nigra*, the alder, *Alnus glutinosa*, and the Bedford Willow, *Salix Russelliana*, according to the soil, are also the best adapted to plant as nurses for rearing the more valuable timber trees.

For low, damp, and boggy soils, the alder, ash, birch, abele-tree, and the willow, are the best.

To resist the effects of the sea-blasts, the sycamore, pinaster, yew, and laburnum have all been found superior to most kinds of trees. The live oak is a very tender tree, and will not exist in England. The habits of the live oak (*Quercus virens*) offer a prospect of this tree being serviceable for the above important purpose. It is a native of South Carolina, and there it is seldom found above twelve miles from the sea-coast. It thrives best when growing on isolated spots or little islands entirely surrounded by salt water. On the estate of Middleburg, situated on the Cooper river, twenty-four miles from Charlton, South Carolina, belonging to J. Lucas, Esq. of New Cross, Surrey, live oak trees averaging twenty-five feet in height, and nine inches in diameter, were selected from the woods by that gentleman and planted in the form of an avenue to his residence. The trees were taken up with as many of the fibrous roots as possible. The tops were lightened by partially reducing the size and number of the branches. Every tree succeeded well, and in the space of two or three years from the time of transplanting they were not to be distinguished from those in the neighbourhood which had grown unmolested. These facts shew that this tree is of hardy vivacious habits, and being also an evergreen, warrants a fair trial of its merits on the coasts of England.

Transplanting trees of large growth for immediate effect properly belongs to another division of the subject, ornamental planting. It may not be unnecessary, however, to state shortly the principles of the practice as lately brought forward by Sir H. Stewart, in his *Planters' Guide*. These are to take up the tree, with all its roots, fibres, and rootlets, and also the green or external system of branches and buds entire and unbroken, then to transplant these roots, rootlets, and external system of the tree in the same perfect state. The soil into which such trees are transplanted should be of a superior quality to that from whence they were taken, or at least that portion of it applied immediately to the rootlets should have an addition of very rotten manure. A point of great importance to success is the selection of the subjects. 1st. The tree should have a superior thickness and induration of the bark compared to that of trees which have grown up in a crowded state. 2d. Stoutness and superior girt of stem. 3d. Numerousness of roots, fibres, and rootlets. And, 4th, extent, balance, and closeness of branches. Where a tree, otherwise desirable, possesses not these protecting properties, it should be provided with them previous to transplanting by uncovering the roots partially, so as not to injure the stability of the tree during the process. To these exposed roots is applied a compost of fine earth, into which they shoot, and produce io two or three years numerous rootlets fit for transplanting. The overgrown branches are reduced so

as to balance the top on every side, if it require it. To assist the bark, such trees as intercept the air and solar rays are removed. These effects are also produced to the roots by cutting a trench at a proper distance from the stem round the roots, and filling up the trench with good soil; in two or three years, the roots will be increased in numerous ramifications as in the former mode.

Chapter IV.

Of the Soils and Sites most profitably employed in the Growth of Timber; intimate Nature of different Soils peculiarly adapted for the Growth of particular species of Forest Trees.

From what has been said respecting the advantages of judicious planting, the lands and sites most proper for the growth of timber will have been generally understood. There has been a difference of opinion whether land under woods or under tillage is the most profitable and beneficial to the proprietors and the public; the question is similar to that which exists respecting the comparative value of tillage land and permanent pasture, and may be solved in the same manner, viz., that the prosperity, if not the absolute existence, of the one is dependent on the other, and the interests of individuals as well as the public on both. The occupiers of land where woods are scarce, or wanting altogether, and those where they are in too great abundance, will coincide in the truth of this observation. The proportion which woods should bear to tillage and pasture lands in any one district of country depends on the nature of the soil, and the local demand for certain kinds of produce.

There can be but one opinion as to the advantages of planting exposed waste lands, and those that are steep, rocky, or precipitous. The loss to individuals and to the nation, by such large tracts of lands as those now alluded to lying utterly unproductive, is incalculable.

Lands of rather a superior quality to those, or which are accessible to the plough, and the barrenness of which is owing to exposure and ungenial climate, offer great inducements to forest-tree planting. For when the improvement is completed it is, to its extent, so much added to the territorial extent of the empire, in affording the means of sustenance as well as the enjoyment of human life*.

Lastly, where the local climate and soil are good, but where, at the

* From among the many instances to be found in Scotland of these effects produced by judicious planting in changing the face of nature from that of a desolate waste to comparative fertility and riches, may be particularly mentioned Blair Adam, the seat of the Lord Chief Commissioner Adam. Here land which, in its natural state, would scarcely afford any rent, has been so much improved by the skilful adaption of the different species of forest trees to the soil and site, the subsequent culture, and, above all, the judicious disposition or arrangement of the masses and narrower spaces of the plantations, as to render the shelter and amelioration of the local climate so genial as to produce corn and green crops as well as permanent pasture capable of rearing and fattening the improved breeds of stock (*a*). In England, barren moor soils have, in many instances of late years, been successfully planted. At East Court, in Berkshire, the seat of Charles Fyshe Palmer, Esq., M.P., a tract of extremely poor heath soil has been successfully planted by that gentleman. In a few years the aspect and climate of this before dreary, barren tract of land, will be completely changed. The plantations of Robert Denison, Esq., at Kilnwick Percy, Yorkshire, are arranged in the most judicious manner for shelter and improvement of the local climate. Mr. Hazlewood's larch plantations at Slaugham Park, in Sussex, are also arranged in the most effective manner for the improvement of the local climate. But there is scarcely a county in England where such barren soils existed, where examples may not be found of the beneficial effects of judicious planting.

(*a*) *Vide Appendix to the Agricultural Report of Kinross-shire.*

same time, a scarcity of timber exists for the periodical wants of agricultural and manufacturing operations, as for the various purposes of buildings, implements of husbandry, fencing, poles, machinery, fuel, &c., planting is of great importance and utility to the community *. In many cases, where the soil is of greater value, the planting may be confined to the angles of enclosures, and to hedge-rows.

In this last case it may be necessary to observe, that the land of the lowest comparative value for corn crops, and the most eligible for shelter and shade where required, should be chosen for planting.

When it happens that not all of these peculiarities of soil and site call imperiously for planting, it is proper to consider whether the value of timber or of coppice produce will not be greater from a given space of ground than that of corn or grass. The rent of the land will assist in determining the point, with the local demand for these crops. From numerous estimates of the returns from woodlands, compared to those of corn and pasture lands, under a variety of different circumstances, as to market for the produce, soils, and situations, 10*s.* per acre, per annum, of rent is considered the general maximum value of land, above which it ought not to be planted, but retained in corn or grass, and all land which rents under that value affords a very superior revenue under woods or plantations. There are undoubtedly many local circumstances which make exceptions to this rule; as where timber is scarce, or where the demand for certain kinds is unusually great, as in the neighbourhood of mines, hop-plantations, &c. There are instances on record of produce of the value of from 20*l.* to 60*l.* per acre, per annum, being afforded by woodlands; these, however, are extreme cases, and are here mentioned merely to show that exceptions may occur to the above mentioned rule; and that such returns are greater than can be expected from any other kind of crop whatever, particularly considering that the cost of culture, as repairs of fences, cutting down, and perhaps carting, is comparatively trifling to that of tillage and manuring, which every other crop of value besides wood requires.

It may be useful to take a more intimate view of the nature or composition of those varieties of soil which have now been alluded to. It is proper, however, to observe, that the following statements of the nature or constituents of these soils are not intended to convey the idea that they are the best sorts respectively for the different kinds of forest-trees, but principally to show that on such soils these trees have attained to great perfection of growth. The soils were selected from the spots where the trees mentioned in connexion with the soils were found by the writer of this treatise, and the trees were, on an average, the finest of the respective kinds which have come under his observation.

* The plantations made by the present Duke of Bedford are highly worthy of notice under this head of the subject, as being planned and executed in the most judicious manner. A statement of the number of trees and quantity of ground planted by John, Duke of Bedford, from the year 1802 to the present period, 1829; *viz.*

	Quantity of Ground. A.	R.	P.	Number of Trees.
Bedfordshire and Buckinghamshire	633	2	24	2,545,357
	Exclusive of 400 bushels of acorns and other seeds dibbled in.			
	A.	R.	P.	Trees.
Devonshire and Cornwall	819	0	0	2,859,754
Huntingdon and Northamptonshire	94	1	34	330,750
	Exclusive of 280 bushels of acorns dibbled in.			
	A.	R.	P.	Trees.
Total quantity of ground planted	1547	0	18	5,735,861
	Exclusive of 680 bushels of acorns, and other seeds dibbled in.			

The great importance of precision in the nomenclature of soils, whether in the details of planting or in husbandry, must be so clear and evident to every person who may be desirous to profit by the results of others' experience in these subjects, that it would be superfluous here to add more on the point.

1st.—Heath soil, or siliceous sandy moor soil, incumbent on shale or ferruginous stones, and frequently on siliceous sand of great depth.

400 parts consisted of fine siliceous sand	320
Carbonate of lime	2
Carbonate of magnesia	1
Decomposing vegetable matter, chiefly composed of the decaying leaves of heath	55
Silex, or impalpable earth of flints	11
Alumina, or pure matter of clay	3
Oxide of iron	4
Soluble matter, principally common salt, or muriate of soda	4
	400

The Scotch fir, *Pinus sylvestris*, the birch, and the beech, are found to succeed better on a soil of the above description than any other kind of tree. For the latter, however, it is necessary that the subsoil should be a deep sand. The larch and spruce, under the like circumstances as to subsoil, will also attain to good perfection on heath soil; but where the subsoil is rocky, or impervious to a free circulation of moisture by indurated sand, which is sometimes the case, these last-mentioned trees never succeed; the Scotch fir only maintains its growth.

2nd.—400 parts of poor sandy soil, incumbent on shale, or very coarse gravel.

Fine sand, principally siliceous	360
Impalpable earthy matter, 40 consisting of carbonate of lime	0
Decomposing vegetable matter, destructible by fire	4
Silex, or pure earth of flints	22
Alumina, or pure matter of clay	7
Oxide of iron	5
Soluble saline matters, chiefly muriate of soda	2
	400

The pine, larch, spruce, birch, and sycamore are the most proper for this kind of soil.

3rd.—Sandy loam, incumbent on siliceous sand, containing a large proportion of oxide of iron.—400 parts.

Fine sand, partly calcareous, and partly siliceous	200
Coarse sand	84
Carbonate of lime	6
Decomposing vegetable matter	15
Silex, or the earth of flints	56
Alumina	12
Oxide of iron	5
Soluble vegetable matter, containing sulphate of potash, vegetable extract, and common salt	4
Loss	24
	400

The larch, pine, and fir tribe in general will succeed well on a soil of this texture, although the beech comes to the greatest perfection, or is, perhaps, the plant most profitable to employ in planting soils of this nature, particularly when the subsoil happens to be deep sand, as is the case of the soil on which the celebrated beech trees grow in Woburn Abbey Park. A figure of one of the finest of these trees is given in Pontey's *Forest Pruner.*

4th.—Light sandy siliceous soil, incumbent on a damp clayey subsoil.

Siliceous sand, of various degrees of fineness	290
Gravel partly calcareous	40
Impalpable loamy matter, consisting of carbonate of lime	5
Silica, or earth of flints	38
Alumina or clay	9
Oxide of iron	5
Decomposing vegetable matter	8
Moisture and loss	5
	400

The oak grows rapidly on this soil, and should constitute the principal timber tree of the plantation. The sweet chestnut also attains to great maturity in the same kind of soil. The nurse trees most proper are the larch, spruce, and particularly the silver fir. The elm planted on this soil had not attained to the size of the above mentioned trees in the same period from planting, but the timber was considered of a superior quality.

5th.—Clayey loam, incumbent on a clay subsoil.

Coarse gravel, partly calcareous	40
Fine sand	190
Carbonate of lime	16
Decomposing vegetable fibre	14
Silex, or pure matter of flints	90
Alumina, or pure matter of clay	30
Oxide of iron	7
Soluble vegetable extract and saline matters, containing gypsum, common salt, and sulphate of potash	5
Loss and moisture	8
	400

This soil brings the oak to the highest state of perfection. The above results of analysis were afforded by an average sample of the soil of a part of Woburn Abbey Park, where some of the finest oaks probably in England may be seen, excepting those of Lord Bagot at Blythfield Park. The following nine trees grow near together on the soil above described, and are therefore here selected to show the powers of a soil so constituted in the production of oak timber.

Oak No. 1.—The bole or stem measures, in timber, upwards of 50 feet in height, and the limbs extend from the stem 40 feet.

				Ft.	In.	
	At 3½	feet from the ground		17	3	circumference.
	At 10	ditto	ditto	14	6	
	At 20	ditto	ditto	14	0	
Oak No. 2.—	At 4	ditto	ditto	17	9	
	At 7	ditto	ditto	15	6	
	At 13	ditto	ditto	13	6	
	At 20	ditto	ditto	12	9	

				Ft.	In.
Oak No. 2.—At 35 feet from the ground			.	11	4
Oak No. 3.—At 4	ditto	ditto	.	13	0¼
At 10	ditto	ditto	.	13	0
At 20	ditto	ditto	.	12	0½
Oak No. 4.—At 3	ditto	ditto	.	12	0½
At 18	ditto	ditto	.	10	0
At 66	ditto	ditto	.	8	0¼
Oak No. 5.—At 4	ditto	ditto	.	14	0
At 20	ditto	ditto	.	12	0½
At 56	ditto	ditto	.	9	0½
Oak No. 6.—At 3	ditto	ditto	.	14	4
At 34	ditto	ditto	.	12	6
The limbs extend from 40 to 46 feet from the bole.					
Oak No. 7.—At 4	ditto	ditto	.	12	0
At 50	ditto	ditto	.	8	0¼
Oak No. 8.—At 4	ditto	ditto	.	13	0½
At 12	ditto	ditto	.	11	0¾
At 50	ditto	ditto	.	8	0½
Oak No. 9.—At 3	ditto	ditto	.	13	0¼
At 20	ditto	ditto	.	12	0
At 48	ditto	ditto	.	8	0¾

The lowest estimate of timber in these nine trees is 3,200 cubic feet of the very best quality for naval architecture. It is remarkable, that though they must be of a great age, no symptoms of decay appear in the growth of these trees; they are perfectly sound and free from blemish*.

6th.—Damp clayey soil incumbent on clay.

Coarse siliceous gravel	60
Fine sand	120
Vegetable matter, destructible by fire	9
Carbonate of lime	15
Silica, or earth of flints	130
Alumina, or pure clay	48
Oxide of iron	10
Soluble saline matter, with vegetable extract, and gypsum	8
	400

The oak, elm, ash, and hornbeam attain to greater perfection here than any other kind of forest-tree. The tulip tree (*Liriodendron tulipifera*) grows freely on this soil when it is properly prepared by trenching. The Norway spruce, pinaster, and Weymouth pine appear to be the only species of the resinous tribe of trees that make tolerable growth on a soil of the nature above described.

* Lord Cowper's Pensanger Park oak, near Hertford, grows in a clay and sand soil or sandy loam.

	Cubic measure.
In 1814, the stem of this tree measured 64 feet high	629 feet.
One limb, 54 feet long	67
	696
Other limbs measured	290
	986

This tree was again measured in 1826, and had increased to 1100 feet cubic measure. The first length of the tree, up to the first branch, is 17 feet, and 19 feet 6 inches in circumference, measuring in cubic contents about 400 feet.

7th.—Fertile peat moss, incumbent on clay or marl.

Fine siliceous sand	231
Undecompounded vegetable fibre	13
Decomposing vegetable fibre	57
Silica, or impalpable earth of flints	50
Alumina, or pure matter of clay	18
Soluble matter, principally vegetable extract	4
Oxide of iron	2
Moisture and loss	25
	400

This variety of peat soil when prepared for planting by draining off the superfluous moisture, with which it is found almost always saturated, is capable of growing very profitable trees, as the birch, abele, poplar, willow, and even the Scotch fir. A piece of ground of this nature, prepared by cutting open drains at such distances from each other, as to leave a sufficient breadth or body of earth to retain a due proportion of moisture in dry weather, and yet prevent saturation of moisture in the wettest weather, was planted with a variety of trees. The trees above mentioned succeeded remarkably well, and made an improved return of a hundred per cent. in comparison to that afforded by the natural produce of the surface. The following variety of peat, which is not uncommon, is to be carefully distinguished from the above:—

8th.—Inert* peat soil.

Fine pure siliceous sand	29
Inert vegetable matter destructible by fire	289
Alumina	14
Oxide of iron	30
Soluble vegetable extractive matter, sulphate of iron, and sulphate of potash	11
Sulphate of lime	12
Loss and moisture	15
	400

The outward characters or appearance of this soil is so similar to those of the first-mentioned variety of peat, that they are scarcely to be distinguished by common observation. The above soil, in its natural state, is absolutely sterile. Large applications of caustic lime and of common salt, in a smaller proportion, had the effect of improving the nature of this soil so much, as to render it capable of vegetating turnip seed, and of bringing the roots to the size of small turnips. It has not been proved, however, what the results of planting forest-trees might be on this soil, improved in the manner now stated.

9th.—Chalky soil, incumbent on chalk-rock.

Calcareous sand	280
Carbonate of lime	60
Decomposing vegetable fibre	5
Silica	28
Alumina	10
Oxide of iron	8
Vegetable and saline soluble matters	4
Moisture and loss	5
	400

* The inert or sterile property of this peat appears to arise chiefly from the excess of sulphate of iron and sulphate of potash and lime which it contains. When burnt, the ashes are found to be a valuable manure for chalky soils.

The beech, ash, and oak thrive better on a soil of the above composition, than any of the resinous or fir species of trees.

10th.—Rich alluvial or marsh soil, on the estate of Lord Saye and Sele at Belvidere, near Erith, in Kent, situated partly below and partly above the level of the river Thames.

	Grains
Fine sand	98
Aluminous grit or stones	68
Carbonate of lime	15
Decomposing animal and vegetable matter	40
Silica or impalpable earth of flints	115
Alumina or pure matter of clay	32
Oxide of iron	12
Sulphate of lime or gypsum	3
Soluble vegetable extract and saline matters, giving indication of not more, or rather less, than the usual quantity found in soils generally of the muriate of soda or common salt	6
Moisture and loss	11
	400

This soil had the character iu the neighbourhood of being incapable of growing any kiud of tree: it was supposed to contain an excess of common salt. The Hon. Twisleton Fiennes has put this interesting question to the test of trial. We examined this soil chemically as above, and found that common salt entered but little into its composition. The stagnant moisture with which it was surcharged appeared to be the chief, if not the ouly defect of the soil. The subsoil in part is peaty and incumbent on a clayey marl. A large open drain was made so as to command the water in the space set apart to be planted. The ground was properly trenched and thrown up into broad ridges, as recommended at p. 22 of this Treatise, with secondary drains between each ridge, communicating with the principal one. The ground was planted with a numerous variety of trees for the purpose of experiment. The results now obtained show that the poplar (*Poplus nigra*), willow (*Salix alba et Russelliana*), elm (*Ulmus montana*), sycamore (*Acer pseudo-platanus*), ash (*Fraxinus excelsior*), alder (*Alnus glutiosa*), locust (*Robinia pseudo-acacia*), birch (*Betula*), oak (*Quercus robur*), horse-chestnut (*Æsculus hippocastanum*), Spanish chestnut (*Castanea vesca*), hornbeam (*Carpinus betulus*), lime (*Tilia eur pœa*), spruce fir (*Pinus abies*), with dog-wood (*Cornus coccinea*), privet (*Ligustrum vulgare*), holly (*Ilex aquifolium*), and hazel (*Corylus avellara*), as underwood;—these different species of trees have succeeded in the order nearly as they have been enumerated, the first eight-mentioned sorts having, up to this period, a decided advantage over the others. The Hon. Mr. Fiennes purposes to continue and extend this interesting investigation; the results of which will decide the question, which is one of importance to the owners of soils of this nature.

Of the above varieties of soils, if we except the sandy loam No. 3, and the clayey loam No. 5, there is not one which, on its natural site, could be profitably cultivated under corn or green crops, but which, by skilful planting, might be made to return considerable profits to the owners, and also to the public the many advantages which judicious planting always confers.

Although there may be found shades of difference in the proportions of the constituents of soils receiving the same designation, such, for instance, as the poor sandy soil, containing ten per cent. more or less of sand in one situation more than another, yet the actual produce of timber,

all other circumstances being equal, will be found to vary but little, if any. But where the difference in the proportions of the ingredients is found so great as exists between the sandy loam No. 3, and the poor sandy soil No. 2, or, in a wood as between any two of the soils now attempted to be described from practical experience in their culture, as well as from a careful chemical examination of their properties and constitution, a very marked and decisive difference will be found in the comparative produce of timber, and in the peculiar species or kinds of trees which should have been planted in the greatest number, or in preference to others,

Chapter V.

Of the most approved Modes of preparing different Soils for the reception of the Plants—Fencing, Draining, Ploughing, Trenching. Of the formation of Rides or Carriage-Ways into the interior of Plantations. O the best Mode of covering these with Herbage.

In no improvement of landed property is economy in the first outlay of capital more essentially required than in forest planting. Want of attention to this important point has caused much loss to the country as well as to individuals, it having had the effect of discouraging forest planting generally, and more particularly of those lands emphatically termed wastes. The evil is perpetuated by statements confounding the expenses of planting different descriptions of land, such as that of a superior soil immediately connected perhaps with a mansion, and that of a distant hill or waste heath. In the former case the return of produce is early, great, and fully ample for every expense judiciously incurred in the plantation; while, at the same time, something must be allowed for obtaining the more immediate ornamental effect of wood. In the latter case the returns of profit are more distant, though equally certain, and the outlay of capital or expense of formation proportionally less. To estimate or make them equal to those of the first description of land, would be absurd, because unnecessary, and, in fact, impracticable, as in the case of rocky sites or thin heath soils, where the more expensive processes of the preparations of soils cannot be carried into effect. To say, therefore, that land cannot be profitably planted under a first outlay of ten pounds sterling an acre, or that the expense of planting should not exceed two, or at most three, is equally erroneous; although both statements, individually with reference to local circumstances, may be perfectly true and accurate.

Fencing is one of the most expensive but essential concomitants of planting; for unless young trees are completely protected by proper fences, extensive failure will be the certain consequence.

In general the materials fit for constructing plantation fences may be found on the spot. On sandy heath soils, the turf interwoven with the roots of heath or coarse herbage affords a ready and cheap material. We have seen a wall or *dyke*, built entirely of turf, last for a great number of years without wanting any repairs whatever. The turfs were cut to the depth of from three to five inches; according to the depth they were pervaded with the tough roots of grasses and heath, which tend to keep them firm and less assailable by the weather. This wall of turf was two feet wide at the foundation, and four feet and a half high, terminating at sixteen inches in thickness at the top. The turfs were built in rows alternately edgeways, and flat with the turf side downwards. The coping consisted of a row of turfs laid with the grass side upwards, and this continued permanent for many years. When the soil is clayey, or of a texture liable to

crumble by the effects of the weather, banks are thrown up four feet wide at bottom, four feet and a half high, and eighteen inches wide at the top. On the top a double row of furze should be sown, and the face of the bank defended from cattle by driving in stakes of forked larch or thorns, from two to two feet and a half in length. These stakes may be fixed in the bank about a fourth of the whole height of the bank from the furze, and pointing obliquely upwards. Where these stakes could be conveniently procured about the thickness of an inch and a half or upwards, we have found them to answer the purposes of a protection to the furze remarkably well: these are the cheapest modes of fencing a plantation. Where stones fit for building a dry stone wall prevail on the site, they may be used with great advantage for constructing the fence. In building a dry stone wall, i. e., without mortar or cement of any kind, it is of importance that occasional courses of stones of a size to reach across the thickness of the wall should be laid in; these act as ties, and render the wall strong and lasting. The coping is another point of importance to be attended to: the best coping is that composed of flat stones placed edgeways, and made compact and immovable by driving in wedges of stone at such distances from each other in the coping as will produce the desired effect, and a very little experience or practice will teach the workman to place these wedges in their proper points. The expense of constructing this kind of fence varies according to local circumstances. The cost of fences of this description is stated by Sir John Sinclair in his highly valuable work, the *Code of Agriculture*, to vary from 4*s.* 6*d.* to 6*s.* the perch, which agrees with the results of our inquiries and experience on the subject.

When neither of the above simple fences can be conveniently adopted, a *quick* or thorn hedge is the most generally used, and in fact is the best and cheapest. There are several kinds of *quick* fences, which differ merely in the mode of planting the thorns (*Cratægus oxycanthus*). The white thorn is a plant much checked in growth by every other, whether herbaceous weed or shub, that mingles with it in the soil. It delights in a strong loam, on poor sands, or damp clay; its growth is much slower, and requires great attention in the preparation of the soil, in the selection of the plants, and in the mode of planting. It must be carefully protected from cattle and rabbits, which, by nipping off the tender first shoots of the spring, seriously injure its growth, and defeat the intention of raising an effective fence at the least cost, and in the shortest space of time.

On poor sandy soils, the depth of earth for the reception of the plants should be made as great as possible, and they should be placed on the top of the bank*. Manure of rotten leaves, compost of marl or clay, and dung, ashes, or any substance that will enrich the line of planting, should be dug in if possible for the encouragement of the roots of the young quick. Where the soil is damp and clayey, planting the thorns on the face of the bank is the best practice. The ground should be perfectly clean, or the cost of weeding it afterwards will be considerable, and the fence will make little progress, if it do not fail altogether.

The cost of the manure above alluded to will be amply repaid by the more rapid growth of the quick, saving much of the expense of weeding, and of filling up blanks and gaps in the hedge, which always accompanies the rearing of this kind of fence on poor or badly prepared ungenial land. The size of the plants deserves particular attention, for by planting strong three year old transplanted thorns, the success of the fence is secured, and the distance of time for its completion shortened by three years. To

* *The Salix cinerea and one or two kindred species make useful and hardy fences if cut in the form of stakes, and driven in on the top lattice-form, seldom fail to strike root, and in the mean time form an effectual barrier.*—*Mr. Kingston.*

protect the thorns from cattle, a ditch with post and rails are adopted. (*Fig.* 8. *a*). When rabbits abound in the neighbourhood of a young quick fence, they are often very destructive to the plants. The means of preventing these animals from having access to the young thorns is too expensive to be adopted for forest fences*. A row of thickly planted dead hedge on each side of the row of quick, is, perhaps, the best temporary protection; but the most effectual mode is to keep down the number of the rabbits, or, if possible, to take them away altogether.

When stones can conveniently be had, the facing of the bank with these, and planting the quick so as to spring through the wall, (*fig.* 8. *b*,) forms the most secure and lasting fence. The expense of weeding is saved by it; and, under such circumstances, the plants generally make great progress.

In the management of the hedges when planted, weeding is most essential, for if coarse grass or rampant weeds are suffered to mingle with the lower branches and foliage of the quick, the injury is very considerable. The top of the hedge should be kept level from the first cutting, until the plants have attained to the desired height. The sides of the hedge ought to be kept also of an even surface; by shortening the side branches every year to within an inch more or less of the preceding year's wood, the bottom of the hedge is maintained equally thick and impenetrable with the upper portion. The most generally approved form of a hedge, is that of the hog's mane; however, if the soil has been properly prepared, the plants selected of the largest size, and the keeping clear of weeds, and most judicious mode of pruning persevered in, the hedge will flourish in every shape.

Fig. 8.

By keeping the top of a hedge level, it is not meant that all the plants should be shortened in the leading shoot of the stem, but only those which overtop their thin neighbours. If this be properly attended to, the evil effects which follow the practice of shortening without exception the leading shoots of every plant of the hedge will be avoided, as well as those which occur when the upright growth of any plant is left uncontrolled until it reach to the desired height.

Where a hedge has been neglected, is overgrown and irregular, the best mode is to cut it down level with the soil, and then to dig the earth about the stumps, inserting plants of strong quick in the gaps where they occur. It may happen that the fence cannot be dispensed with, for the time the young shoots from the old roots require to renew the fence. In this case, the mode of cutting a fourth part of the stems to the desired height, and another fourth part a few inches from the ground, and warping the remainder with these, is found a useful practice.

Besides the white thorn or quick, and the furze (*Ulex europæus*), there are many other shrubs which may be planted under certain circumstances with effect as fences. In exposed cold soils, the Huntingdon willow, beech, birch, and alder, may be used with advantage.

It may be unnecessary to mention, that where larch poles can be had, they afford an excellent material for fencing, particularly when used with

* For protection to gardens against the depredations of rabbits, or turnip crops exposed in the fields, &c., a wire netting has been invented, which completely answers the purpose. The expense for these purposes is so moderate, as to render the adoption of the wire netting no matter of difficulty. We witnessed the effects of the practice at Cautley Hall, the seat f John W. Childers, Esq.

the bark, which tends to preserve the wood from the effects of moisture and air*.

Draining is essential wherever stagnant moisture prevails in the soil. Boggy lands and tenaceous clays are chiefly the soils which require it, for trees will thrive in a degree of moisture that would be highly hurtful to the nutritive grasses, and to corn crops. Under drains are of little service for forest-trees, as their roots soon render these ineffective. In general, therefore, open cuts should be used. Where the excess of dampness is caused by springs, as in most bogs and morasses, it is essential to ascertain the source of the principal springs which feed the secondary ones, and their numerous outlets over the surface. Sub-aquatic plants, as the alder, rushes, &c., often point out the spots where the search should be made, although these plants are frequently supported by stagnant surface water. Boring with the auger is the best mode of ascertaining the source of the spring, or at least that level of its course in the strata which conducts the water to the boggy land, and where it can be effectually cut off from supplying the secondary springs and outlets in the lower levels. When the source is ascertained, a drain should be cut to the depth of the strata through which it passes, so as to obstruct its progress. It should be made sufficiently deep, or the water will continue to pass under it, and the work will be useless. From this main drain formed across the declivity, other secondary drains should be made to conduct the water thus collected, from the source to the most convenient outlet. It would be incompatible with the space of these pages to enter into details of this subject. Elkington's mode of draining, as given in Johnstone's Treatise on the subject, is on the above principle, and shews with precision the advantages of it, and with how much facility lands, which by the old method of draining were considered incapable of being profitably improved, may be made fit for planting and returning a valuable produce of timber.

Clayey soils which are rendered barren by surface water stagnating upon them, may be made to produce valuable timber by the simple process of constructing open drains, and forming the surface between these into ridges, as before mentioned in Chapter III.

On steep acclivities, rocky soils, and thin heath, or moor lands, incumbent on rock or shale, where ploughing or trenching is impracticable, a depth of pulverized soil cannot be obtained for the reception of the roots of trees of more than two, or at most three years' growth; the mattock planter, diamond dibble, and spade, cau be used with the best effect. To attempt any more expensive preparation on such lands, than may be made by these implements for the reception of the individual plants, would be injudicious. The number of valuable woods which have been reared in this way, are too generally known to need particular mention here. The cost may be stated to be from two to five pounds per acre. For the preparation of heath soils, incumbent on sand or loose gravel, an improved paring plough (*fig.* 9 and 10), which we call Fyshe Palmer's planting plough†, is a valuable implement.

The plough consists of two mold boards as in common use, but resting on a triangular and somewhat convex plate of iron (*fig.* 9). This iron

* It is the opinion of some practical persons, that the bark being left on larch poles, encourages or attracts insects to nestle under it, and thereby hastens the decay of the wood, unless it happen that the trees are cut down in winter, or when the sap is down.—*Mr. Lance.*

† Charles Fyshe Palmer, Esq. M.P., in planting a large tract of waste land on his estate of East Court in Berkshire, after various trials, found this plough which he invented a most effective implement in paring off the heath-turf. It economises time as well as expense.

plate is furnished with sharp steel edges riveted to it (*fig.* 10, *c*). The fixed share (*a*, *fig.* 10), which divides the turf for each side of the double moldboard, is six inches high at the shoulder, with a sharp edge tapering to a point at (*b*). The sole of the plough is screwed and bolted to the instrument by the bolt sockets (*e*), and the nut screw sockets (*d*). The base of the triangular plate *f* (*fig.* 9) is twenty-one inches, with a curve of one inch, which facilitates the action of the instrument when paring in gravelly or stony ground. The whole length of the plate is thirty-five inches from the base (*f*) to the point of the share (*b*). Wherever the land is of a moderately level surface, and when paring is desirable, this plough will be found a valuable implement. The whole surface may be pared as in clayey soils, where burning the turf is essential; or spaces of twenty-one inches, as in heath soils, may be pared off with intervals of thirteen inches, on which the reversed turf may rest to decay, and become food for the roots of the trees. When the soil is of sufficient depth to allow of trenching, the common plough, following the track of the paring plough, will effect this object at a comparatively small expense.

Fig. 9.

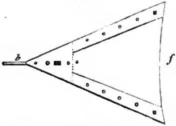
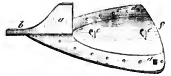


Fig. 10.



Much difference of opinion prevails on the comparative advantages and disadvantages of trenching ground for forest trees; nothing is more certain than that trenching and manuring is more advantageous to the trees than holing, or any other mode of preparation. But there are certain soils which will produce valuable timber, and that cannot be ploughed or trenched; these have already been mentioned: there are others which are capable of receiving benefit from this mode of preparation, but where it would be inexpedient to bestow it. There is one instance in which trenching cannot on any account be dispensed with, which is that of ground near a mansion, where the value of trees in respect to landscape effect, shelter, shade, concealment, and the improvement of local climate, have equal if not superior claims to that of the actual value of the timber produced by the individual trees of the plantation. The question as regards other sites and soils, intermediate between these two now mentioned, and of a nature as regards texture and quality similar to the soils described in Chapter IV., under the numbers 3, 4, 5 and 6, which are capable of rearing mixed plantation, or a variety of different species of forest trees in perfection, the process of trenching or ploughing, and also manuring when possible, ought to be adopted. In this instance, however, it is highly necessary, before adopting the more expensive preparation, to ascertain exactly the cost of each mode of planting, and the probable return of profit from the outlay. As many local circumstances interfere with the performance of these different processes, as the comparative cheapness of labour, of manure, the facility of obtaining the most proper sized plants, to anticipate two or three years' earlier return of produce, &c., it would be of little use here to give any calculations of expense and profits, as data by which to estimate the results of either mode of practice, that would be applicable

to every soil and site alluded to. Where the local demand for the smaller sized products of plantations are great, the more expensive process of trenching should be adopted, inasmuch as the growth of forest-trees to the size of poles, and of materials for fencing, &c., is highly promoted by trenching and manuring, and the returns of profits from these products of planting are in proportion earlier and larger. That this superiority extends in the same proportion to the ultimate produce of timber in trees, may not appear so clear, because it may be urged by those who undervalue trenching and manuring as preparation of the soil for planting forest-trees, that there are no satisfactory records of the comparative rate of increase of timber, or of solid vegetable fibre, after the first twenty or thirty years' growth of the different species of forest-trees, which have been planted on trenched and manured grounds, and the contrary, being under all other circumstances the same until their last stage of perfection; and yet the truth of such continued superiority of increase, is the only test by which the question can be decided, and an unerring rule of practice be obtained. The results of mere observation, or conclusions drawn from the apparent contents of trees, will not be found to warrant the adoption of any new mode of practice. But the comparative increase and ultimate produce of timber should be ascertained up to the period of the trees attaining to perfect maturity in the most satisfactory manner, by actual admeasurement; and correct records kept of the age of the trees, comparative value of the plants when planted as to their size, roots, and constitutional vigour at the time of planting; as also the intimate nature of the soil, subsoil, and local climate. In the oak, after the first fifty or sixty years' growth, the annual rate of increase of the diameter diminishes greatly. The Lambert pine-tree (*Pinus Lambertiana*), mentioned in the *Trans. Linn. Society*, vol. xv. p. 497, exhibited an increase of diameter of four inches and a half only at the base, during the last fifty-six years of its growth.

These last remarks apply to the question generally; but in all cases of exception before mentioned, and in the instances of clayey, tenacious soils, and compact gravelly loams, trenching ought doubtless to be adopted as a preparation for the reception of forest-trees*.

* The advantages of trenching have been zealously and ably advocated in a late publication by Mr. Withers, to which we have already referred, and the proofs brought forward in support of his arguments are satisfactory as far as they go; but the most important facts are those of the superior increase, and the comparative quality of the timber when the trees have attained to full maturity. Registers of the facts stated by Mr. Withers, continued until the trees attain to full timber size, and of the buildings or purposes to which, in certain cases, the timber is applied, are what would afford invaluable information, and for which posterity would be grateful. A distinguished writer asserts that after the first twelve or twenty years of growth of trees planted on land prepared by trenching, all distinction is lost between the *apparent* growth of these and of those which may have been planted by the simple process of holing. In general cases, the observations of the writer of this have led to precisely the same conclusions. It is improbable, however, that the superior growth which so distinctly marked the progress of the plants on the trenched ground during the first years of growth should wholly cease, but that it diminishes in proportion as the soil, which had been loosened by the process, becomes consolidated to its original state, and in proportion as the roots advance in the subsoil which had remained equally undisturbed in the execution of both modes of preparation, is quite certain. Whether this superior rate of produce, though reduced in degree, continues until the tree attains to perfect maturity, or ceases before that period, we have certainly no records of facts to shew. Further, as regards the progressive increase of wood in trees, different species vary in this particular. The locust, for instance, will make shoots of six feet in length for a few of the first years of its growth, or, if cut down when in a healthy state, will produce in one season shoots of three yards or more in length; but to conclude from this circumstance that the locust is one of the fastest growing trees, or even that it is equal in this respect to the slow growing oak, would be erroneous, inasmuch as, at its fifteenth

In order to have at all times the most convenient as well as the most pleasant access to the interior of the plantation, rides or broad drives should be marked out and left unplanted. On heaths and gravelly soils the surface is in general so level and unbroken as to require the lines or edges of the rides merely to be cut out in the form of a shallow water-course, any inequalities of the surface to be made good with the turf or earth taken out. In damp, clayey soils, the rides should be made higher in the middle and sloping on each side to an open drain, marking the line of each side*. The earth should be made fine and sown with the following grass seeds, *viz.*, *Alopecurus pratensis*, *Dactylis glomerata*, *Lolium perenne*, *Cynosurus cristatus*, *Phleum pratense*, *Anthoxanthum odoratum*, *Poa trivialis*, *Festuca pratensis*, with red and white clovers combined, at the rate of four bushels and a half to an acre. For dry, sandy, heath soils, which can scarcely be covered with verdure, the following will be found effectual:—*Festuca*

year of growth, the annual rate of increase in height is found to be reduced to inches instead of yards or feet, and at the age of thirty or forty years it may be said to cease altogether to advance in stature; while the oak, which has before this period overtopped the locust, continues its comparatively steady annual increase for a century. And, with certain modifications of the rate of annual increase between the first and subsequent stages of growth to perfection, the same principles will apply to the willow (a), poplar, alder, birch and the pine tribe, on the one hand, and to the oak, chestnut, elm, beech, ash, &c., on the other.

(a) The Bedford willow (Salix Russelliana) when planted on a damp, clayey loam, on a rising site, has been observed by the writer of this to attain to the height of thirty feet in five years, but after that the annual rate of increase diminished to inches, and then the tree became in appearance stationary. The celebrated willow in Staffordshire, known under the name of Doctor Johnson's Willow, is of this species. Since the above was sent to the press we have had the gratification of perusing the *Salictum Woburnense*, or a catalogue of the willows indigenous and foreign in the collection of the Duke of Bedford, at Woburn Abbey. This contains the fullest account of all the different species of this interesting tribe of plants that has yet appeared. As regards the willow above alluded to, it is observed in the introduction to the work by the noble author, that 'the Rev. Mr. Dickenson assured Sir James Smith and myself that the great willow at Lichfield (commonly called Johnson's willow, from a belief that it had been planted by him) was of this species. Dr. Johnson never failed to visit this willow when he went to Lichfield.' In 1781 it was reported to be nearly eighty years old, and Mr. Dickenson says, 'the venerable sage delighted to recline under its shade.' The noble author further observes, 'I can state another instance from my own personal knowledge of this species of willow attaining a great size within the ordinary period of a man's life. A willow-tree on the south lawn at Gordon Castle, in Scotland, was planted by the late Duke of Gordon about 1765; it was then in a small box four feet square, floating on the surface of the lake, and shortly sank on the spot, where it took root. The lake has long since disappeared, and the tree was blown down in a storm on the 24th November, 1826, the tree being then sixty-one years old. I examined this tree a few years ago, and found it to be the *Salix Russelliana* of Sir J. E. Smith.'—*Salictum Woburnense*, Introduction, vi.

* At Blair Adam, in many instances, the plantations were originally made with broad rides; in others where that was omitted in the original planting, it has been accomplished by cutting out the trees. These, while the plantations were young, served the double purpose of access, for the convenience of carrying out the thinnings and for pleasure, because then it was possible to proportion the loading of the carriage, by putting a greater or smaller number of trees, according to the state of the rides in point of moisture or distance; but now that one tree makes a load, and that its weight cannot be diminished, the injury done to the ridings was so great as to impede both the convenience and the pleasure of the rides, and great expense was incurred in putting them in repair. To avoid this, what are called wood or thinning lanes have been adopted, by cutting out trees in proper lines for them; this shortens distances to the place of deposit (for rides are always circuitous) and is of benefit to the woods by admitting air more generally, care being taken that they are so twisted as not to incur the risk of being blown down. It is proposed (as they are easily got) to fill the rutts with broken stones. Where stones are not easily to be got, the rutts might be filled with trees not otherwise useful, so as to make a sort of coarse railway. This plan will, in the end, save a great deal of expense and labour, and secures at all times the proprietor's access to the woods and his seeing what is going on.

ovina, Festuca duriuscula, Aira cæspitosa, Aira flexuosa, Cynosurus cristatus, Agrostis stolonifera and *vulgaris, Achillea millefolium, Trifolium minus*, and white clover. Game are fond of these grasses.

Chapter VI.

Of the Culture of Plantations; Soil; Pruning; Thinning; remedies for accidental injuries and Natural Diseases of Forest Trees. Of the Tanning afforded by the Bark of different Species of Trees.

The judicious culture of plantations is a point of the last importance to secure a full return of profits from the capital expended in their formation, as well as for every other advantage that judicious planting confers; for let the care and skill employed in their formation have been ever so great, if the proper culture be not continued from the period of planting to maturity of growth, disappointment in obtaining the effects of wood, and loss of profits will be the certain results. The numerous instances to be seen almost everywhere of the bad effects resulting from the neglect of judicious pruning and thinning of the trees of plantations, and the great loss caused thereby to the proprietors, evince fully the importance of this branch of the subject, which embraces the following points:—

1st. Culture of the soil.
2d. Pruning.
3d. Thinning.
4th. Remedies for accidental injuries, or natural diseases.

First. The culture of a trenched soil of a newly-formed plantation, consists in keeping the surface clean of weeds until the shade of the trees prevents their growth. It is true that these weeds take a portion of nourishment from the soil, but from what was before stated regarding the food supplied to the plants by the soil, it is clear that the growth of herbaceous weeds can injure but little, if in any degree, the growth of forest-trees. When the trees are young and of a small size, however, the mechanical effects of these weeds are extremely hurtful when they are suffered to grow and mingle their shoots with the lower branches of the young trees, by obstructing the free circulation of air, and preventing the genial influence of the solar rays from reaching to their tender shoots, and this is evident to common observation in the decay or death of the branches subjected to contact with them, and in the consequent unhealthy appearance of the leading shoot of the tree.

Hoeing the surface as often as may be required to prevent perennial weeds from forming perfect leaves and new roots, and annual weeds from perfecting seeds, is all that is required. Two seasons of strict adherence to this rule, even in the worst cases, will render the labour or expense of future years comparatively trifling, and the healthy progress of the trees will reward the care and attention.

On soils planted by the slit, or holing-in mode of planting, it is essentially necessary to prevent the natural herbage of the soil from mingling with the lateral branches of the young tree. An active workman with a steel mattock-hoe will clean round the plants on a large space of ground in a day. Summer is the best season for the work, as the weeds are more effectually destroyed, and the partial stirring of the soil about the roots of such plants as require cleaning benefits their growth.

Should the planting and culture now described have been faithfully

executed, there will be few failures. When these happen, however, the vacancies must be filled up, at the proper season, with stout plants, and the holes be properly prepared for the reception of the roots. It is a good practice for the first two or three years of a trenched plantation to take a crop of potatoes, mangel wurzel, or carrots, according to circumstances. The rule, which must be strictly adhered to in the introduction of these crops, is, that no part of the foliage or tops of the green crop touch or even approximate near to the young trees; a rule of practice which, if broken through, produces equal damage as from a rampant crop of weeds to the plantation.

Second. There are three different kinds or modes of pruning, which, in practice, have been named close pruning (*a*, *fig.* 11). Snag pruning (*b*), and foreshortening (*c*).

Fig. 11.

By leaving a snag (*b*) of the branch, it in time forms a blemish in the timber, in consequence of young wood forming round the stump, and embedding it in the tree. Snag pruning is the most rude and injudicious mode that can be practised, being invariably attended with injury to the quality of the timber: it should never be adopted under any circumstances whatever. Close pruning (*a*) is performed by sawing or cutting off a branch close to its parent stem or primary leading branch (*c*). This is the only mode to be adopted in training, or rather improving, the stem or bole of a tree, or wherever it is desirable that no reproduction of branches from the point should follow. The most perfect manner of executing the work is to saw the branch off close to the parent stem, and smooth any roughness that may be left on the surface of the wound with a sharp knife, taking care not to reduce the edges of the bark which surround the wound more than is actually necessary to remove the lacerated surface. To prevent the action of air and moisture on the naked wood, a dressing should be applied, composed of ingredients that will adhere to the spot, and resist the action of drought and rain. Three parts of cow-dung and one of sifted lime will be found a very effective substitute for the more compound dressing of Forsyth. The dressing should be laid on one-quarter of an inch in thickness, or more when the wound is large: when rendered smooth and firmly pressed to the part, powdered lime should be thrown over the surface, and pressed into it by the flat side of the pruning knife, or a spatula. The bark will sooner cover the wound when protected from the influence of the weather by this or by any similar means, than when left naked and exposed *.

In general forest pruning this process is unnecessary, or rather the benefit is not sufficiently great to warrant its cost; but for particular trees connected with ornamental effects it is well worth the trouble.

Fore-shortening pruning (*c*) is the only one that can be usefully practised

* The fate of Mr. Forsyth's discovery of a composition applied to heal the wounds of trees, and to renovate decaying vital functions of vegetable growth, is similar to that of all other discoveries where the principles of such are pushed too far. Hence, one party ridicules it as good for nothing, and another pronounces it as infallible; while the truth lies between. In a long practice the writer of this has always used it with beneficial effects in every case where it was more than usually desired to have the bark speedily closed over a wound in a tree, but for the ordinary cases of forest-tree pruning it has never been used, and for the reasons before stated.

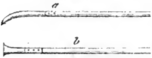
in reducing the size of lateral branches. When these become too crowded, or when particular ones assume a disproportionate vigour of growth and increase, it is highly useful to reduce the number or size of such over-luxuriant branches. The chief point to be attended to in the operation is that of dividing the branch at a point from whence a healthy secondary branchlet springs, that it may become the leader to that branch. When the shoot is of one year's growth only, and has no lateral shoots, as in stone-fruits trained on walls, the division is made near to a strong healthy bud, which will become the conducting shoot.

For young forest-trees which require the branches to be regulated and balanced, so that one side may not have a disproportionate number or weight of branches to the other, and for trees in hedge-rows whose lateral branches extend too far on either side, injuring the quick fence or the crops of the field, fore-shortening is the most useful mode of pruning.

For non-reproductive trees, such as all the different species of the pine or fir tribe of forest-trees, this mode of pruning is improper, as the branch thus shortened does not produce a second shoot, but remains with all the objectionable properties of a *snag*, to the great injury, in time, of the quality of the timber. Where the purposes of evergreen masks, near the ground, in the margins of plantations are desirable, the foreshortening of the leading shoots of spruce firs, &c., is highly useful, as these trees do not afterwards increase in height, but only extend laterally by thin side branches.

The most effectual pruning instruments are a strong knife, hook, saw, and chisel. For pruning elevated branches a small saw firmly fixed to a long handle is highly useful (*fig.* 12, *a*); a chisel, likewise furnished with a long handle (*b*), and driven by a hand mallet, is very effective in taking off branches close to the stem or bole, in circumstances where the saw cannot be freely used from the upright direction of the branch, or the situation of the adjoining branches. Such are the manuals of forest-pruning. It may be justly said that in no one process of the culture of forest-trees is a just knowledge of vegetable physiology, or that of the structure and functions of the organs of vegetable life of more importance than in this one of pruning, which directly and especially applies to the assisting and directing, as well as the checking, of these functions in the production of wood as in forest-trees, and in that as well as of flowers and fruit in garden-trees. Some of the leading points of vegetable physiology which bear directly on the practice of pruning, have been mentioned in Chapter III., and full details may be obtained in the work there cited.

Fig. 12.



A timber tree, as before observed, is valued for the length, straightness, and solidity of its stem. Judicious pruning tends greatly to assist nature in the formation of the stem in this perfect state. In natural forests, boles or stems possessing properties of the most valuable kind are found, where no pruning, trenching, or any other process of culture ever was applied to the rearing of the trees. It should not, however, be concluded from this circumstance that these processes are of little value. If we examine the growth of trees in this climate, when left to the unassisted efforts of nature by the neglect of pruning and thinning, we find that but a small number only, on any given space of planted ground, attain to perfect maturity, compared to those which never arrive at any value but for fuel. The like results, though varying according to local advantages, are exhibited in the produce

of self-planted forests. Hence, instead of an average of two or three perfect trees on any given space (suppose an acre) left by the unassisted efforts of nature, we shall have from forty to three hundred perfect trees, according to the species of timber, by the judicious application of art in the preparation of the soil and the after culture of the trees, and probably on soils, too, which, without such assistance, could never have reared a single tree.

But though judicious pruning greatly assists in the production of a tall, straight bole, free from blemish, yet unless those circumstances before mentioned are favourable, as a vigorous, healthy constitution of the plant in its seedling stage of growth, transplantation to its timber sites at a proper age, and a soil suitably prepared and adapted to the species of tree, pruning will be found but of small efficacy*.

It was supposed that when branches are taken from a tree, so many organs of waste are cut off; and it has been practically insisted upon that, by the removal of large branches, the supply of sap and nourishment which went to their support would go to a proportionate increase of the stem. From what has already been stated respecting the course and movement of the sap, it may be unnecessary to add that this opinion is erroneous in principle, and that when a branch is cut off a portion of nourishment to the stem is cut off also specifically from that part of it which lies between the origin of the branch and the root, downwards to the root. Every branch of a tree, of whatever size it may be, not only draws nourishment and increase of substance from that part of the stem which stands under it, and from the roots, but also supplies these with a due proportion of nourishment in return, and by which their substance is increased. If the branch, whether large or small, acted merely as a drain on the vessels of the stem, and that the sap it derived from it was elevated to the leaves of the branch, and from thence returned no farther than to the origin or point of its union with the stem, then the above opinion would be correct: on the contrary, however, when it is found that the existence and increase of every twig, branch, and leaf, depends on a communication with the root, and that this communication passes through the stem downwards to that organ, and from it upwards periodically, and, moreover, that every periodical series of new vessels thus formed in the branch has a corre-

* At Blair Adam pruning was resorted to, in some instances, where the trees were too far advanced in age for that operation, but it was rendered necessary, in those instances, by due attention not having been paid to those portions of the wood at an earlier period. The rule then and there followed was, not to cut off any branch which left a horizontal surface exposed: they were cut so as to have the surface of the cut in the line of the stem, with a very sharp heavy bill, at the time the sap was rising: the effect of this was uniformly to secure a considerable growth of the bark over the wound before winter set in. This has obtained stem for the trees that were so treated, but it is greatly feared that when they are put to use, there may be weaknesses (in the dockyards called blanks) at the parts where the pruning has taken place.

To make valuable wood, length of stem is essential, and the practice at Blair Adam, in consequence of experience, has been to obtain this by knife pruning in the earlier years, by bill pruning as they grow older (say to twenty-five years, when the lateral branches are easily cut and soon barked over), then by leaving them to press upon each other more severely than vigorous thinners would permit.

Two effects seem to be produced by this:—First, they draw each other up to stem;—secondly, they produce a certain decay in the lower lateral branches. When those effects are sufficiently attained, and before any risk is incurred to the power of the tree to obtain thickness, the thinning is commenced by gradually, and according to the best judgment that can be formed, taking out the inferior trees and those best grown trees which injure each other, but taking care to do this so gradually as to secure against any chill or sudden effect of cold, so as to bring about (what may be called) the injury of being bark-bound,—the most effectual impediment to growth either in height or thickness.

sponding series of vessels formed in the stem from its point of emitting the branch to the root, it is clear that a branch not only increases in substance by the functions of its own organization, but must, of a necessity, periodically increase the substance or diameter of the trunk.

The results of practice agree with this; for if an overgrown limb or branch of a free-growing tree be pruned off, the annual increase of the diameter of the stem is not found to exceed its previous rate of increase; or the excess, if any, is not equal to the contents of wood which had been periodically formed by the branch or branches thus separated from the stem*.

It is reasonable to inquire, if the sap or nutritive fluid, periodically supplied by the roots immediately connected with the large branch takeu off goes not to a proportionate increase of the stem, to what channel is it directed? It has already been mentioned (in Chapter III.) that the vessels which convey the periodical supply, and the roots which collect it, are annually produced; and the fact is, that when the primary organs and stimulus of production, (i. e. the leaves and green system of the plant,) are takeu away, the annual rootlets and spongeols connected with these vessels cease to be renewed, until another branch, or series of branches, are reproduced by the vital power acting on the sap in the vessels of the stem connected with the numerous latent germs of buds in the bark near to the wound, or those dispersed in its neighbourhood. Hence it is, also, that should the season of the year of pruning the branch be that in which the sap is accumulated in the largest quantity in the leaves, and in the smallest proportion in the vessels, scarcely any reproduction of branches follows the operation of pruning; and hence, also, the different effects of summer and of winter pruning as regards this point.

When branches are not allowed to perfect one year's growth, but are pruned off annually within a hud or two of their origin with the stem, they act rather as organs of waste than those of increase of wood to the stem. But although the rate of periodical increase of the diameter of a tree be thus lessened, in a certain extent, by the loss of a full grown lateral branch, yet the increase of the stem in height or length is not thereby retarded, the ligneous vessels of the root corresponding with those of the stem or wood, probably act with hut little diminished force in sending up sap to the higher extremities of the tree†.

It is of great importance that hranches which indicate an over-luxuriant growth should never be suffered to become large, or to exceed the medium size of the majority of the boughs of the tree, but should be pruned off close to the stem when the general interests of the plant will admit of it. These over-luxuriant branches, which, when suffered to take the lead in growth of the general boughs, become so hurtful to the perfection of growth of the stem, are evidently produced and supported by the accidental circumstance of a superior portion of soil being in the way of,

* In numerous and varied trials made by the writer to ascertain this point, the results have always gone to prove the above facts.

† In a few instances, fer the sake of particular effect, and to enable carriages to pass, there have been, at Blair Adam, limbs ef considerable size cut from eaks of fifty years eld and upwards. The cut would have been herizental; but by making the surface ef much greater size, they were made perpendicular. By great attention, all injury was prevented te the trunk, and the wounds are new healed over (at the distance of twelve or fifteen years from the date ef the eperatien). Whether it has accelerated or retarded the diameter-growth er thickness of the trees cannot be stated, as ebservatian was not ealled to it, but they have certainly inereased as much in that respect as the trees around them of the same sort and age. In ene instance, the cutting ef a limb, where the tree cleft, has had the effect of setting the other stem upright, so that it appears now exactly in the perpendicular line, and like the original stem ef the tree.

and into which the roots immediately connected with these boughs penetrate and afterwards keep possession. By taking off such branches early, therefore, the extra supply of nourishment afforded by such local circumstance of soil is directed to the stem and useful lateral branches.

It has been already observed, that, by depriving a tree, to a certain extent, of its side branches, the growth of the stem in length is promoted, but the diameter, strength, or thickness of it is not increased in the same proportion. When the side branches are destroyed by natural causes, or by the neglect of judicious thinning, the like injurious effects ensue to the primary object here in view, that of obtaining the largest quantity of timber of the best quality on a given space of land.

When the lateral branches perish or cease to be produced, except towards the top of the tree, from the want of pure air and of the vital influence of the solar rays on the foliage, the existence of the tree may continue for years, but the produce or increase of timber of any value ceases, and it dies prematurely, affording at last a produce comparatively of no value, after having obstructed the profitable and healthy growth of the adjoining trees during its latter unprofitable stages of life. In the contest for the preservation of existence which takes place after a certain period of growth among the individual trees of a plantation which has been neglected, or left without the aid of judicious pruning or thinning, there will be found trees which, from the accidental circumstance of having originally a vigorous, healthy constitution, and from partially escaping the numerous injuries and obstructions of growth that accrue to trees by neglect of culture, have attained to a valuable timber size. The timber of the few such trees, however, as have thus gained the supremacy, is frequently much blemished by the stumps of the dead branches having become imbedded in the wood; and this serious injury to the quality of the timber and value of the tree, is the invariable consequence of neglecting to prune off these stumps as soon as they appear, or rather neglecting to cut away close to the stem such branches as indicate decay, and before they cease growing.

The time at which pruning should begin, depends entirely on the growth of the young trees. In some instances of favourable soil and quick growth of the plants, branches will be found in the course of four or five years to require foreshortening, and in case of the formation of forked leaders, to be pruned off close to the stem. When the lateral branches of different trees interfere with each other's growth, pruning, so as to foreshorten, should be freely applied in every case, in order to prevent the stagnation of air among the branches, or the undue preponderance of branches on one side of the tree. Perfect culture, in this respect, requires that the plantation should be examined every year, and by keeping the trees thus in perfect order there will never be any danger of making too great an opening, or depriving a tree too suddenly of a large proportion of branches. The operation will also be so much more quickly performed, as to render the expense of management less than if the pruning were delayed, or only performed at intervals of years, as is too frequently practised. By this management there will be little, if any, necessity for pruning close to the stem, until the tree attain to twenty feet in height, or even more than that, provided the stem be clear of lateral branches from five to eight feet from the root. When the lateral branches are regular and moderately large, the smaller length of clear stem may be adopted, and where the branches are larger towards the top, the greater space of close pruning. Five years from the first close pruning will not be too long before the second is performed; one, or at most, two tire of branches

may then be displaced in like manner. The increase of diameter of the stem, is the only certain test for deciding whether the larger or smaller number of branches may be pruned off to most advantage, or whether it may be prudent to take any away from the stem until it attain greater strength and thickness. By examining the trees of a plantation annually, the critical time for pruning every branch for the best interest of the trees is secured. Some trees may be pruned with great advantage successively for years, whilst others may only require it every three or five years, and others again not at all.

It has been disputed whether resinous or non re-productive trees are benefited by pruning; but the value of judicious close pruning to that tribe of trees cannot be doubted: at the same time it is but too true that, in numerous instances, it has been carried to a mischievous excess. Young firs and larch trees, when deprived of their lateral branches, to within four or five tire of shoots of the top, are frequently seriously injured by the winds acting on the tuft of branches,which become as a lever loosening the roots, and producing all the evils of a suddenly checked growth, besides those of excessive bleeding or loss of the resinous sap, and the want of the periodical supply of nourishment to the stem afforded by these branches. At sixteen years of growth, larches standing at four feet apart, will be benefited by moderate pruning; *i.e.*, of two or three tire of the lowermost branches, particularly should these appear to be *decreasing* in their former vigour of growth; and afterwards in every third or fourth year, successively, the like treatment should be adopted to these lowermost branches evincing a decline of healthy growth. The same rule applies to the pine or Scotch fir and the spruce; but the former, having large and compound branches, should be pruned at an earlier age than the latter, or before the lateral shoots are more than two inches in diameter. When the branch to be taken off is several inches in diameter, the wound is so large, the excavation of resinous sap so great, and the heart-wood, or the vessels which constitute it, so indura'ed, as to render the perfect union of the new and the old wood less certain than in young branches, all which make the removal of large branches productive of more evil than service t the growth of the tree and quality of the timber. On the contrary, when the pruning of the pine is altogether neglected, and the dead or rotten stumps or snags of branches are left to be embedded in the wood, or to form cavities for the accumulation of water or other extraneous matters in the substance of the stem, all the purposes of profit and of pleasure are sacrificed to neglect or unskilful culture.

Judicious thinning may be said to be productive of the same valuable effects to a plantation of timber-trees in the aggregate, as those which judicious pruning produces on every individual tree composing it: by the admission of a proper circulation of air and the solar rays, and permitting the free expansion of the essential lateral branches of the trees, as well as by preventing an unnecessary waste or exhaustion of the soil by the roots of all supernumerary trees.

The great advantages of judicious thinning are not confined to the object of obtaining the largest quantity of timber of the best quality on a given space of land in the shortest space of time; but the produce of the trees thus thinned out ought to afford a return sufficient to pay the expenses of culture, interest of capital, and the value of the rent of the land. In many instances the profits arising from the thinnings of well managed woods have covered these charges before the period of twenty years from the time of planting. The time at which the process of thinning should be commenced, depends on the like causes as those which regulate pruning, and need not here be repeated.

In general the freest growing plantations require to have a certain number of trees taken out by the time they have attained to eight years of growth from planting. On forest-tree soils of a medium quality, the age of ten or twelve years may be attained by the young trees before thinning is necessary; but should fifteen years elapse before the trees demand thinning, it will be found that the plantation has been imperfectly formed.

No certain rule can be given to determine the number of trees to be thinned out periodically, which will apply to all plantations and to every kind of forest-tree in them. A well-grounded knowledge of the principles of vegetable physiology, and of the habits of trees, is absolutely essential, to execute with success this very important branch of arboriculture. We may, however, quote the following statement from practice as one example, taken from an average of acres on an extensive plantation in Sussex:

One acre of siliceous sandy soil, worth 7s. per acre, when under pasturage, being properly prepared and planted with larch, at three feet and a half apart, required thinning for the first time, when the trees had attained to ten years of growth.

Number of trees when planted 3555 on one acre, of which 100 had failed during the first ten years of growth; therefore when the thinning commenced the number was 3455.

Number of Years Growth when thinned.	Number of Trees left on each occasion of thinning.	Distance of the Trees, Ft.	In.	Number of Trees thinned out.	s.	d.	Value. l.	s.	d.
10	3097	3	9	100 worth	0	4 each.			
				200	0	3	4	13	0
				58	0	2			
				100 vacancies from accidents.					
15	2722	4	0	55	0	10			
				100	0	6			
				120	0	4	7	4	2
				100	0	1			
20	2411	4	3	20	1	6			
				91	1	0			
				150	0	4	8	17	8
				50 fuel	6	8			
27	2073	4	7	20 worth	2	0			
				25	1	6			
				100	1	0	13	14	0
				193	0	6			
35	1440	5	6	25	2	6			
				100	1	6			
				275	1	0	32	3	3
				233	0	9			
43	1031	6	6	30 worth	3	0 each.			
				50	2	6			
				200	1	6	32	4	0
				129	1	0			
51	680	8	0	40	3	6			
				100	2	6			
				150	2	0	37	11	0
				61	1	0			

The future returns of income from the plantation, now rest on six hundred and eighty trees nearly arrived at their perfection of growth. The distance of nine feet apart is considered a sufficient space for the larch,

spruce, and silver firs, to attain to their maximum of timber growth, on soils of an average quality adapted to their habits; and as the above trees may profitably occupy the soil for twenty or thirty years more, or without ceasing to produce timber annually for that period, the thinning now should depend on, or be regulated by, the circumstances of demand for the produce, more than for the benefit of the individual trees which remain.

In the above details of thinning, it will seem to demand an explanation, why certain trees of the lowest value at fifty years' growth should have been left apparently to encumber the ground, while trees of a value equal to these are cut down at ten years' of growth. The answer to this question brings us back again to the difficulties before alluded to, of giving any data, or rules applicable in all cases, founded on number, size, distance and time, for the execution of the different processes of culture, relative to assisting and controlling the functions of vegetable life, so as to produce a given result, or obtain a specified quantity of timber from certain trees under different circumstances of soil, site, local climate, and culture.

If all trees were produced from seed with the same degree of constitutional strength, and were the soils on which they might be planted of the like nature throughout, and under equal circumstances with regard to moisture and exposure, as well as to every other influential point, then statical rules of practice for the culture of trees might with equal certainty be given, and of as general an application to suit every variety of case, as those for the execution of any mechanical art: but the reverse of all this is the fact; and every variation in the soil, and in the exposure and growth of the trees, must be met with a corresponding variation in the process of culture, as regards the number of trees to be thinned out, the distances at which they should stand, and their size and age. The trees above mentioned, which at fifty years' growth were not of greater value for the purposes of timber, than several trees thinned out at ten, assisted the growth of the more valuable trees, which immediately or more remotely adjoined them, by the shelter they afforded against cutting winds, and by ameliorating the local climate, to that degree as to fully warrant their continuance. Those trees which were of equal value to these when cut down at ten years' of growth, stood so close to others of greater promising value as to injure the growth of both, and had they been suffered to remain, would have prevented some of the most valuable trees of the plantation from attaining to perfection. Thus, on the one hand, by removing the former description of plants, the most valuable trees are promoted in growth, and on the other preserved from injury, by suffering less valuable ones to remain.

Various tables have been calculated to assist in deciding on the number of trees to be thinned out of plantations at stated periods; one of these by Mr. Waistell*, appears to be brought to as near a correct average, as the nature of the subject will permit.

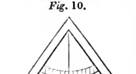
'The following table shews the number of trees to be cut out in thinning woods, and the number left standing at every period of four years, from twenty to sixty-four years, reckoning that the distance of trees from each other should be one-fifth of their height, and that the trees should have increased twelve inches in height, and one inch in circumference annually, and to have been at first planted four feet apart.'

* Transactions of the Society of Arts, vol. xxvi., and Withers's 'Memoir on planting and rearing Forest-trees,' p. 37.

Years old and feet high.	Girt.	Contents. Ft.	In.	Pts.	Distances.	Number of Trees on an Acre.	Contents of the whole in feet.	Number to be cut out.	Contents. Feet.
20	2½	0	10	5	4.	2722	2362	839	727
24	3	1	6	0	4.8	1883	2824	494	741
28	3½	2	4	7	5.6	1389	3308	326	776
32	4	3	6	8	6.4	1063	3779	223	792
36	4½	5	0	9	7.2	840	4252	160	810
40	5	6	11	4	8.	680	4722	118	819
44	5½	9	2	11	8.8	562	5194	90	831
48	6	12	0	0	9.6	472	5664	70	840
52	6½	15	3	0	10.4	402	6130	55	838
56	7	19	0	8	11.2	347	6611	45	857
60	7	23	5	2	12.	302	7076	37	866
64	8	28	5	4	12.8	265	7537		

When there is a deficiency of access to certain parts of the plantation, and additional rides or drives must be made, the lines should be marked out by barking the trees in the course of it, or, what is better, by a circular mark with whitewash or lime. The roots should be grubbed up, and the surface of the ground prepared and sown with the seeds mentioned in Chapter V. When there are steeps or hills, the drives should be formed with the most easy ascent for the convenience of timber carts. The ascent ought not to be greater than one foot in thirty. The most useful instrument for determining the ascent or descent of forest drives, is constructed in the form of the common level, furnished with an index divided into ninety degrees. When the plummet line hangs at the forty-fifth degree, the legs of the instrument indicate a perfect level (*fig.* 10), and when it hangs at a lesser or greater number, it indicates the degree of ascent or descent accordingly. In plantations the thinning of which has been neglected, the trees next the sides of the drives are always the largest and most valuable, and afford a test at all times to judge how far judicious thinning has been practised or neglected. When this essential part of culture has been neglected, the greatest caution is necessary in performing the work. The trees being grown up slender, weak, and deficient of side branches, a too sudden exposure to the winds or currents of air, will be found injurious, if not fatal. The outside trees should be continued in their thicket state for several years after the first relief is given to the interior trees, and even then should only be deprived of decaying companions, or of branches unnecessary for the purposes of shelter, but which it may be advantageous for the trees to lose. Trees weakened by growing in a crowded state, become more obnoxious to disease, and to the attacks of insects, and to that of parasitic plants, such as mosses and lichens, which rarely or never appear on healthy and vigorous trees. The number of trees to be taken out on the first occasion of the thinning of a neglected plantation should be very limited, and confined to those which have become the most exhausted. The process should be carried on for six or seven years, until completed. The pruning of such trees should be confined to the removal of decaying or dead branches, until the gradual introduction of fresh air, and the solar rays by the thinning process has renewed lateral shoots and invigorated the branches*. Forest-trees are, like other organized bodies, confined to a

Fig. 10.



* It is a great error to suppose, that by leaving trees in an individually crowded state, the object of a close cover is secured; on the contrary, this object will only be gained for

certain period of existence, in which the stages of growth are distinctly marked, from the first development of the plant in its seedling state, until its ultimate decay by the course of nature. Different species of trees have different periods of existence. The oak is considered to be of the longest duration, and, perhaps, the larch of the shortest. The oaks in Woburn Park, mentioned at page 50, as being of such large dimensions and in perfect health, cannot be supposed to be under three hundred years of age. The elm may be placed next in order with the chestnut, ash, beech, and hornbeam, the pine, and lastly the larch*. These estimates of the comparative duration of different species of trees are, however, given from observation only, and are not founded on such certain data as to render them more than an approximation to the truth; for soils, local climates, and the various other causes which promote or retard the progress of vegetable health and growth, interfere with the completion of the perfect, natural term of vegetable life in numerous instances. Under the most favourable circumstances, however, of soil and culture, trees are subject to various diseases and accidents, and from what has already been mentioned, as to their structure and living functions, this will be no matter of surprise. The diseases of forest-trees may be comprised under those of a general nature, wherein the internal functions are interrupted or partially destroyed; and secondly, those of a local nature arising from external causes, as accidents of various kinds, and the attacks of insects. Neglect of judicious planting and of after culture, are the chief causes of the first mentioned kinds of disease, and tend to aggravate the bad effects of other accidents. When a tree puts forth leaves of paler tint than their natural green colour, and never assumes it again during that and succeeding seasons, and when the growth of the branches is very small and frequently imperceptible, some of them also decaying at the extremities, the disease is termed *chlorosis*. It originates principally from an ungenial subsoil. The effects of confined air by a crowded state of the plantation, or a too sudden exposure to sharp blasts, will also induce this disease. Topical remedies are of no use, and the means of prevention should be used in planting, and in the after culture.

Spontaneous bleeding, or great loss of sap, generally ends in the disease termed *tabes*, which, when once confirmed, is incapable of being cured. The elm is of all forest-trees the most subject to this disease. Whenever the branches become disproportionate to the stem and roots, or the foliage too scanty to receive and elaborate the periodical flow of sap, spontaneous bleeding takes place. The neglected stumps of dead branches having formed cavities, afford ready outlets to the sap. Branches which have been suffered to grow too large in proportion to the rest of the tree, and are bent down or project in an horizontal direction from the stem, are frequently attacked with *hæmorrhagy*, which, according to our observation and experience, never heals, but continues periodically until the death of the tree. The fluid which is thus discharged by the elm, appears to differ in no respect from the ascending sap of the plant, affording extractive and mucilaginous matters, combined with potassa and lime; the solid matter deposited by the fluid in its course of descent over the bark, leaves a whitish tract at first, but in time becomes blackened by the weather, smoke, &c. The track thus marked out by the hæmorrhage, will point out the wound with certainty and readiness. Grass and herbage on which this fluid drops

a few years at first, or until the trees interfere with each other's healthy growth, and begin to contend for existence. By judicious pruning and thinning, or by keeping any individual tree in its most perfect healthy state, a perpetual cover will be obtained, as complete as the species of tree and the nature of the soil will admit.

* The Pinus Lambertia before mentioned, found on the north-west coast of America, was estimated of nine hundred years' growth, although sound in the timber.

is destroyed by it. When there is made a strong effort of the functions of the plant to heal up the wound, and, after it is almost wholly closed with healthy bark, a substance of a dark colour and resinous appearance is exuded. This substance is termed *ulmin;* as a pigment it produces the most beautiful brown, and appears to consist of a peculiar extractive matter and potassa*. The oak, under the like circumstances, exudes a substance having similar external characters. The birch and maple, when cut or lacerated through the bark into the wood, suffer much from the loss of sap which flows from such wounds.

The pine and fir tribe of trees have a resinous juice, which exudes freely from wounds of the bark. When large branches are injudiciously pruned off, the injury is considerable from the waste of sap. In the cases of full-grown trees of the elm being affected with this disease, the best course is to take them down for timber; but where it is desirable to preserve the tree for landscape or ornamental effect, the decayed stumps should be cut away close to the sound bark, and the wound dressed carefully to protect it from the weather. If a cavity exists out of which the sap has, for a considerable period, been in the habit of exuding, the aperture should be cleared of the dead bark covering its sides, and then the mouth should be securely closed by the composition before recommended, or by any other substance that may be found more effectual to prevent the admission of rain, and of air. Whatever tends to increase the number of healthy branches and leaves on the tree, will the most effectually restrain the disease.

Tabes, or the wasting of trees, is brought on not unfrequently by parasitical plants, as Ivy, covering the cutis of the barks, and preventing the healthy functions of that organ. The loss of the green colour of the leaves, the gradual wasting of the branches, and diminution of the foliage, indicate the confirmation of the disease. If taken in time the remedy of cutting the ivy at the root is speedy and effectual. When lichens pervade not only the stems but the branches of trees, the functions of the bark are disturbed, and disease ensues. On damp soils, where proper thinning is neglected, lichens and mosses propagate to the extremities of the branches, and flourish in a surprising degree. Caustic lime water thrown upon the parasites will destroy them without injuring the tree, provided it be done during the fall of the leaf. A hand-engine will apply the lime water to a great many trees in the course of one day. The necessity of topical applications, however, of this sort for forest-trees, ought to be avoided by timely thinning and pruning, thereby admitting a circulation of pure air, and the solar rays into the interior of the plantation, which check the propagation and growth of parasites.

The number of different species of insects which infest forest-trees is very great; they are all productive of more or less injury to the growth of the plants. The most destructive are:—

			Time they appear.
**Noctua pinastri*, Lin.	*xylena*, *Hüb.*	pine moth	June.
fimbria	oak moth	.	August.
pyramidea	copper underwing	oaks	,,
macilenta	brickmoth	elms	,,
citrago	sallow moth	limes	,,
alniaria	canary-shouldered moth	limes	,,
erosaria	. . .	limes	September.
olivaria	green carpet moth	birch	August.
betulitana	. . .	.	,,

* Agricultural Chemistry, p. 105. Ulmin is elsewhere stated to be an acid *sui generis*, and, like other vegetable acids, to be a compound of carbon, hydrogen, and oxygen—that it combines with potassa like an acid, and is again precipitated from it by acids having a stronger affinity for potassa.

Noctua rapezana	diamond-back moth		August
iciana	white backed	willow	,,
upsilon	dismal moth		,,
retusa	double kidney moth		,,
nupta	red underwing		,,
**Scolytus destructor*	bark beetle	oak and elm	March.
**Lasiocampa quercus*	egger moth	oak	July.
crataegi	hawthorn moth	white thorn	,,
**Coccus lariceo*	larch scale	larch	,,
abietis	spruce fir bug	fir	,,
aceris	maple bug	maple	,,
alni	alder bug	alder	,,
betulæ	birch bug	birch	,,
quercus	oak bug,	oaks	June, July.
salicis	willow bug	willows	June, July.
tiliæ	lime bug	limes	June, July.
carpini	hornbeam bug	hornbeams	June, July.
capreæ	crack willow bug	salix caprea	June, July.
oxycanthæ	thorn fly	white thorn	,,
Aphis ulmi	elm fly	elm	June, Aug.
quercus	oak fly	oaks	,,
pini	pine fly	pines	,,
tiliæ	lime fly	limes	,,
fraxini	ash fly	ash-tree	,,
betulæ	birch fly	birch-tree	,,
fagi	beech fly	beech-tree	,,
aln	alder fly	alders	,,
salicis	willow fly	willows	,,
bursaria	black poplar fly	black poplar	,,
aceris platanoides	maple fly	maples	,,
Cynips quercus folii	gall fly	oak	,,

The pine moth nestles in the leading bud of the pine, and destroys its principal shoot. The attack of this insect often injures a whole plantation, as they propagate fast, and prefer the terminal bud of the stem. If on the first appearance of the insect, or before it had affected more than two or three trees, means were immediately had recourse to for destroying them, and guarding every season to prevent them from establishing themselves in numbers, the prevention of their ravages would be thus effected at a moderate cost of labour or expense.

The *scolytus destructor* is a formidable insect. It penetrates through the bark into the alburnum, on which it feeds, destroying the organization of the bark, and annihilating its functions. In time the bark separates in large masses from the wood, and the tree dies. The elm is most obnoxious to this insect *. The pine is also subject to attacks of the same kind, and attended with the like fatal effects.

* It has been supposed to be the effect of disease rather than the cause of it, or of living on the dead and decaying juices; but when we never find the insect in life on a dead tree, but always on a living one, and that oftentimes in the full vigour of health, we cannot conclude otherwise than that the *scolytus destructor*, if not the only cause of *tubes* or a wasting of the plant, is one of the primary ones, and is never an effect. Very recently a number of elm trees, of a considerable age and size, in the neighbourhood of Camberwell, died in a very rapid manner. The bark became detached from the stem, and fell off in large pieces, or could with small force be removed by the fingers for a space of five feet from the root upwards.

The bark was perforated by the scolytus in numerous instances, and their ravages on the alburnum were evident by crowded tracks through its substance. There were a very few of the trees which escaped destruction; but even these had perforations of the bark,

The larva of the *lasiocampa quercus* sometimes strip the leaves entirely of the branches of the oak. When the trees are young, and the attack is perceived before it has made great progress, the application of caustic lime water, served by the hand-engine before mentioned, is the only topical application we have found practicable, as regards cost, time, and effectiveness.

The different species of coccus or scale-like insects which infest most trees, seldom attain to such numbers as to endanger seriously the health of forest-trees.

The aphis or fly is more common and injurious. Almost every distinct species of tree has a species of aphis peculiar to itself. The glutinous substance which, in hot arid weather, appears so general on the upper surface of the leaves of trees, is produced by these insects. This substance, by attracting other insects, and by arresting smoke and dust on the surface of the leaves, prevents the leaves from performing their healthy functions. For large trees and extensive plantations topical remedies are of course out of the question. In confined cases a solution of soft soap, or of water impregnated with caustic lime and sulphur, are either of them very effectual cures.

The gall fly (*cynips quercus folii*) deposits its eggs in the membrane of the leaves of the oak, and produces those tumours on the leaves called oak galls. The extent of injury inflicted on the general health of the tree has never been observed to be great, or such as to warrant any expensive trial for a cure.

The last disease, or rather defect, that may be mentioned here, is termed *shake*, and should be carefully guarded against in the culture of forest-trees. Trees, though outwardly to all appearance sound in the stem, are often found with splits of several feet in height from the root upwards. This is frequently caused by strongly bending the stem of a tree from the top when young. The stem of trees in plantations which have been neglected in judicious thinning and pruning, being tall and slender in proportion to the branches of the top, these act as a lever to the wind, and in time produce this blemish in the timber. In carrying out

although in smaller number. Before the bark began to peel off, gas pipes had been laid near the foot of one row of the elms, the time had been only about six weeks, and the mischief was imputed to the escape of the gas among the roots. This reason, however, was untenable, inasmuch as trees removed to a considerable distance from the gas pipes were equally affected; while a few already mentioned adjoining it escaped. Besides, the foliage shewed no signs of being affected, which all gaseous poisons have the immediate effect of shewing first on the leaves. In this instance the state of the trees, previous to the introduction of the gas pipes near to the roots, showed that the *scolytus destructor* had been one of the several causes that produced the death of the trees. These elms were in rows, and formed an avenue. They had been planted too close in the rows, and had also been neglected in thinning and pruning. The remains of dead stumps, and the numerous cavities left by others, marked out by the discoloured traces on the bark of the long existence of an yearly hæmorrhage of sap, and also the scanty tops in proportion to the size of the stems, all proved that the disease *tabes* had been confirmed. Add to this the bad effects of drains, and deep foundations cut out in the immediate neighbourhood of the trees, accompanied by two excessively dry seasons (1825 and 1826) so favourable for the propagation of the *scolytus destructor*, and the crisis and results of the disease will not be any subject of wonder. A tree of the *pinus pinaster*, which had been reared in a pot, was subjected to the influence of gas the same as that supplied to the roots of the elm, but without producing any perceptible effect. A large ox bladder was filled by the writer of this with the carburetted hydrogen gas, and connected by a pipe with the draining aperture of the pot, in which the roots of the pine were confined. This quantity of gas was made to pass through the earth in the pot during the space of forty-eight hours, and renewed and continued for three weeks; but, as just now observed, without producing any ill effects on the health of the plant. The pine is liable to be injured and destroyed by the insects before mentioned, in the same manner as the elm.

the produce of the thinning of a plantation, as well as in executing the work in a careless manner, the same bad effects are not unfrequently produced in young saplings. The decay which is observed at the lower end of the stems of larch trees, when planted on chalk, or on very damp clay, is clearly the fault of the subsoil, and sometimes appears when the tree is only eighteen years old. In numerous instances we have found it commence at the seventh year's annual layer of wood, and never earlier, and to extend to the thirty-fifth year's layer, but not beyond that growth. In all our observations it appeared to be either within seven and thirty, or thirty and thirty-five years' layers. The fungus, which appears in the defective wood, commences at the higher portion of the main branch of the root connected with the annual layer affected, and proceeds upwards. Its characters are extremely similar to those of the *dry rot* (*merulius destructens*), so much so, that until more minute observation determine to the contrary, they must be considered identical. It is highly probable, therefore, that the *dry rot* exists in the interior of timber, while the tree is yet growing, although possibly in too inert a state to be distinguished by the naked eye. In the living plant no remedy has yet been discovered for this disease. Judicious planting will ensure prevention by furnishing each distinct variety of soil and subsoil with those species of forest-trees only which are best adapted to them; and this principle, whether in the herbaceous plants of husbandry, in fruit trees in gardening, or in timber trees in forest planting, is never violated with impunity. Various means have been tried, from time to time, to prevent the appearance of dry rot in timber, as well as to arrest its progress when once begun. The first of these objects is supposed to be gained by *seasoning* the timber previously to using it. Some recommend the bark to be taken off the tree to a certain height a year before it is felled, and the practice has been tried long ago on the oak *, and more recently with the larch. It would appear, however, in the latter case, that when the trees are young, the alburnum or sap wood becomes soft rather than hard under the process.

Another mode of seasoning timber is by immersing the trees in water for a period of one or more years. This practice is considered very beneficial, but it is clear that the necessary proofs cannot be obtained under a period of many years comparative trials of seasoned and unseasoned wood in the same building, and under the same circumstances in the building. The seasoning of wood by subjecting it to a strong heat by means of steam has also been tried, but, as in the former case, time is required to determine its efficacy. When wood is left to the process of nature to become seasoned, the desired effects are more perfectly produced by protecting the wood from rain and sun. Knowles, in his Essay on Dry Rot, recommends the timber to be 'kept in air neither very dry nor very moist; and to protect it from the sun and rain by a roof raised sufficiently high over it, so as to prevent by this, and other means, a rapid rush of air.' Confined air and a moist temperature encourage the propagation and growth of the *merulius destructens* in a high degree. When unseasoned wood is painted, the latent seeds of the dry rot are thereby encouraged and assisted in vegetating and spreading the fungus or algæ with destructive rapidity.

The proper season for cutting down timber-trees is that in which the sap is most quiescent, *viz.*, midwinter and midsummer; but particularly the

* In 1737 Buffon disbarked three oak-trees, forty feet in height, where they stood, and they remained in that state for three years; they were then cut down, and the results were found to be in favour of the practice.

former. Trees whose bark is valuable require to be felled before the complete expansion of the leaf. From the middle of April to the end of June is the proper time for the oak; the larch should be peeled earlier. The birch having a tough outer cuticle of no use to the tanner, and as this is more easily separated from the proper bark after the sap has partially circulated in the leaves, it is generally left standing until the other species of trees are felled and barked.

The process of barking is, in general, well understood. The harvesting of the bark is of the greatest importance, for if it be suffered to heat or ferment, it loses its colour, becomes mouldy and of little value. The best mode is to make what the foresters term temporary lofts of about two feet in width, and of a length sufficient to hold a day's peeling of bark. These lofts are formed by driving forked stakes into the ground for bearers, about three feet in height in the back row, and two and a half feet in the front; a sloping floor is then constructed by laying loppings between the forks of the bearers. The bark is then placed on the sloping floor with the thick ends towards the top or higher side, the smaller bark is laid on to the depth of six or ten inches, and the broad pieces placed over the whole as a covering to carry off the wet, should rain happen before the bark is sufficiently dry to be stacked. In three or four days it should be turned to prevent heating or moulding, and in ten days, more or less, it will be sufficiently dry to be stacked until wanted for the tanner. In order to prevent fermenting when stacked, the width of the pile should not exceed eight feet. The roof should be formed and thatched as a corn or hay stack. In preparing the bark when ready for the tanner, it is cut into pieces about three inches in length, and weighed. It is sold by weight.

The quantity of tannin contained in the bark of different forest-trees has been ascertained by Sir Humphry Davy, and although the proportion of tannin afforded by the bark varies according as the spring may be favourable in temperature, the following numbers will be found to express nearly their relative values, if the larch cut in autumn be excepted :—

Average of entire bark of middle-sized oak, cut in spring	29
of Spanish chestnut	21
of Leicester willow, large size	33
of elm	13
of common willow, large	11
of ash	16
of beech	10
of horse-chestnut	9
of sycamore	11
of Lombardy poplar	15
of birch	8
of hazel	14
of black thorn	16
of coppice oak	32
of oak cut in autumn	21
of larch cut in autumn	8
white interior cortical layers of oak bark	72*

In general the bark of the larch is not worth more than half the price of oak bark, and the proportion given to larch in the above table may, therefore, be considered too small. The great disproportion between the produce of tannin afforded by the inner bark and that of outer layers, shews with what care the harvesting of the bark should be performed to prevent

* Agricultural Chemistry, p. 79.

fermentation, which destroys the tannin principle first in that portion of the bark containing it in the largest quantity.

The weight of bark afforded by given contents of timber, varies according to circumstances connected with the growth of particular trees, as whether grown in confined air, or in healthy, open situations, also as regards the age of the trees. The statements given by Mr. Monteith, in his 'Planter's Guide,' are, perhaps, as near to the truth of an average as the nature of the subject will admit, at least they are consonant with the results of our own practical experience.

	Every cubic foot of timber affords of bark lbs.	lbs.
An oak 40 years old	from 9	to 12
Ditto from 80 to 100 ditto	" 10	" 16
Larch timber, per foot	" 8	" 10
Birch timber, large ditto	" 11	" 14
Willow, ditto	" 9	" 11

The most judicious mode of felling forest-trees is by grubbing up, or taking the solid part of the root with the bole, in every case where coppice stools are not wanted, for the expense of taking up the roots afterwards when either planting or tillage may be demanded on the sites of the felled trees, will be found to exceed that of taking up the root with the stem in the first instance, besides the injury to the immediate fertility of the soil by the introduction of fungi and insects, the first agents generally of decomposition of the roots of felled trees which do not stole or reproduce shoots. Besides the advantages now alluded to, there is another, that of the value of the solid part of the roots of trees. The peculiar structure of many roots afford the best materials for what is termed ornamental rustic work; and also the compact texture of the wood, and the diversified lines of the medullary rays and concentric circles, fit it for the manufacture of very interesting cabinet works.

The root of the larch affords a valuable material for forming knees of boats. Admiral Fleming was the first, we believe, to point out this property of the larch. The lower part of the stem, with the solid root attached, is quartered, and, when joined, form knees of a lasting nature,—that part of the wood, the solid root produced under ground, and always in contact with damp, being probably more adapted to withstand the effects of moisture than the proper wood produced in the open air.

Chapter VII.

Of the progressive increase of size or produce of wood in different species of forest-trees. Of the mode of valuing plantations—present value—prospective value of certain individual trees which have attained to great maturity. Of the products of plantations, and of the terms used by foresters to denote these products.

It is a common observation, that the slower a tree grows the harder is its wood. This statement, as applicable to trees of different species or genera, as, for instance, between the poplar and the oak, is generally correct, but between individual trees of the same species, two oaks, for example, the observation will be found not to apply; indeed the reverse will be found proved if we examine into the facts which bear directly on the point. In every plantation we find that the individual trees composing it vary considerably in what is termed quick or slow growth,

and that in all plantations where the pruning and thinning have not been judiciously executed, the trees which stand on the outside of the plantation, or on the sides of the drives, are larger, say double the size, or have been of much quicker growth than those in the interior of the plantation. Now the greatest comparative degree of strength and hardness of the woods of the two trees is proved to be in that of the larger, or the tree whose growth was most rapid and vigorous—the sap wood being of course larger in the fast-growing tree, as are all the annual layers of the heart wood. If the reader will look back to page 8, where the structure of the wood of different species of trees is described and figured, it will be seen that the wood of the oak, a comparatively slow-growing tree, is distinguished from the wood of the poplar, a fast-growing tree, by having the cellular structure comparatively confined to the concentric circles which mark the annual increase of wood; that the number of cells between these concentric circles are few, though of a larger diameter, while in the wood of the poplar they are dispersed in great number, or crowd the whole surface of a section of the wood. If the hard wood of the locust (*fig. n*, p. 10) be compared to the soft wood of the fir (*fig. o*), to the labnrnum (*fig. q*), the lime (*fig. p*, p. 11), sweet chestnut (*fig. e*), to the horse-chestnut (*fig. h*), and every hard and durable wood to the soft and non-lasting kinds, the same clear and marked distinction will be evident, *i.e.* the hard, tough, and durable woods have the cells chiefly confined to the annual rings, or thinly scattered in irregular groups, leaving comparatively wide intervals of apparently solid fibre, while all the soft or non-lasting woods have the entire suhstance pervaded with minuter cells, in number and regularity that may be compared to the texture of fine lace or net work.

These then are the external discriminating characters of hard and of soft woods; and let us now apply these to distinguish the woods of fast and of slow growing trees of the *same species*, and we find that the wood of the fast-growing tree has wider intervals between the concentric circles, or congeries of cells, or, in a word, fewer cells to the size or diameter of the wood, and is consequently wood of greater strength, toughness, and durability. The experiments of Professor Barlow on the strength of different woods confirm the above conclusions*. The opinion of Thomas

* Mr. Withers, in his Letter to Sir H. Stewart, p. 115, states, that he received from Mr. Boorne, of Erpingham, a respectable timber-merchant, two specimeos of oak, one taken from a fast, and the other from a slow growing tree. No. 1. was grown upon a very *strong good soil*, the age of the tree about sixty years, and it contained from thirty-eight to forty feet of timber. No. 2 was about one hundred and twenty years old, and was grown upon a light soil, with gravel about two feet below the surface. These specimens being submitted to Professor Barlow, of the Royal Academy, Woolwich, were tried, aod gave the following results :—

Specific gravity.	Deflected one-fiftieth of its length with	Broken with	Comparative strength.
	No. 1.		
903	660lbs.	999lbs.	1561.
	No. 2.		
856	414lbs.	677lbs.	1058lbs.

No. 1, it appears, is, therefore, of about medium strength, my mean nnmber being for Eoglish oak, 1470.

No. 2 is very weak, my weakest specimen being 1205. (See Essay on Strength of Timber.)

Mr. S. Farrow, timber-merchant, Diss, Norfolk, states to Mr. Withers, that ' It has always been a custom with me when I wanted a mild, tender piece of oak for any purpose, to look out for a slow-growing treo to cut it out of; and, on the contrary, when hard wood was wanted, to take the fast-growing tree, one which, before heing felled, was in full and rapid growth, and I have ever found the latter much the most durable wood.' Two specimens of oak communicated by Mr. Farrow, No. 1, of a tree reared close to the rick-yard of the farm, and by the side of a ditch into which ran a great deal of moisture from the yard.

Andrew Knight, F.R.S., on this important subject is, that the toughest and most durable oak timber is obtained from trees of vigorous, rapid growth. The property of quick growth, in some species of trees, however, is confined to their earlier stages; in others it is not developed until they have stood several years in the soil, and in several the rate of annual increase of wood continues steady comparatively until the trees attain full maturity.

The locust-tree (*Robinia pseudo-acacia*), for instance, will outstrip the oak in the first ten years of their growth by a rate of increase at least double that of the latter, but afterwards the oak will gain upon the locust,

This tree grew rapidly, and, contained, when taken down, one hundred and sixty cubic feet of timber. The tree from which No. 2 was cut grew in the samo field, and believed to have been planted ot the same time. This tree grew well, but not in any degree so fast as the other, and contained about ninety cubic feet of timber. The age of the trees was estimoted at one hundred and twenty yeors growth. These specimens were forwarded by Mr. Withers to Professor Barlow, for examination as to their comparative strength, and the following interesting results were obtained:—

No. 1.—Fast Grown Oak, Manured.

Specific gravity.	Weight when deflected the piece 1-50th of its length.	Broken with	Comparative strength.
972	606lbs.	999lbs.	1561lbs.
No. 2.—Slow Grown Oak, Natural Soil.			
835	439lbs.	943lbs.	1473.

The strength of the fast-grown ook timber is, therefore, in this instance, superior to that of slower growth, as 15 to 14 neorly.

On these facts Mr. Withers observes, that 'the tree, which hod no support but the natural soil, produced ninety feet of timber in ona hundred and twenty years; the other, whose roots were continually nourished by manure, made one hundred and sixty feet in the same period, being a difference of seventy feet. The mounred tree made, on an overage, one foot one-third of timber in each year. Estimating, therefore, according to that rate of increase, this tree was, fifty years ago, of equal size, and of greater value, to the unmanured tree at the time it was cut down. Now, if wa reckon the value of the timber at only 8*l.* a load, and allow compound interest for the fifty years, tha difference of value between the manured and unmanured tree amounts to upwards of 165*l.* This,' continues Mr. Withers, 'is the amount of profit arising upon one tree; let a calculation, founded upon such data, be applied to the millions of acres which might be covered with forest-trees; and then let land-owners ond statesmen reflect, whether *aur own country* does not afford ample and profitable employment for all the "surplus agricultural labourers."' The cost of trenching ond manuring, according to Mr. Withers' own experience, is stated to be as follows:—

Planted in April, 1824.	*l.*	*s.*	*d.*
Twenty loads of marl, at 1*s.* 3*d.*	1	5	0
Twenty ditto muck, at 5*s.*	5	0	0
Ploughing land	1	10	0
Trees, carriage, and planting	7	10	0
Totol cost per acre	15	5	0

The results afforded to Mr. Withers by the above preparation of the soil, and by subsequent culture of the surface of the soil, were such as to be perfectly conclusive in favour of trenchiog ond manuriog to *holing* in unprepared soils. Now making every reasonable deduction for the uncertainty of the two oaks last alluded to having been reared under the same circumstances in every particular, which influences and governs the growth and progress to perfection of forest trees, (as already mentioned in Chapter II.,) except that of the supply of liquid manure to tha tree No. 1, and making a similar deduction for the uncertainty of obtaining manure, ond also that of the comparative rate of increase of timber between trees planted in the mode Mr. Withers recommends, or by the cheaper mode of holing, after the first twenty or thirty years of their growth, there are evidently advantages left sufficient to warrant the adoption of this mode of planting all soils of the noture mentioned at p. 39, whether on privote estates or in the royal forests. In either cose a certoin sum con only be afforded, and it is then to be considered whether that sum had better be employed on a limited spoce of land onnually, by which a speedier return of profit will be obtained, and the ultimate object, that of a stronger and more valuable quality of timber reared to perfection in a shorter period of tima, or by covering a larger space of lond with plants which will give inferior returns in a much longer extended period of growth.

and its rate of progress will continue superior. The silver fir increases comparatively at a much inferior rate to the larch and other fast-growing trees, for ten or more years, but in general it passes all these trees in height and in circumference by the thirtieth or fortieth years of its growth.

The comparative rate of increase annually of the following forest-trees is, in the average of cases, nearly in the following order:

Poplar,	for the first	50	years of growth.
Bedford willow	. do. .	25	ditto.
Birch .	. do. .	20	ditto.
Larch	. do. .	60	ditto.
Sycamore	. do. .	50	ditto.
Pine .	. do. .	60	ditto.
Silver fir,	after the first	30	ditto.
Alder .	. do. .	25	ditto.
Locust .	. do. .	15	ditto.

Trees of slower growth, but more equal in the rate of annual increase throughout their progress, are

Elm, ash, beech, sweet chestnut, oak.

On comparing a variety of measurements made of different trees on the same soil, and also of these in soils of different natures, the increase of the oak to that of the larch, at sixty-five years of growth, proved to be as 6 to 3.6 nearly. The silver fir stood to these in the proportions of 8 to 6 and of 8 to 3.6 *.

When a tree has attained to full maturity, or to as large a size as the nature of the soil and situation are capable of inducing, the annual production of shoots from the extremities of the top branches is scarcely perceptible. When these begin to decay, and the tree gives indications of soon becoming what is called *stag headed*, the profitable increase of timber has ceased in that tree, and it no longer occupies the ground profitably. The most profitable stage of growth, however, at which a tree may be taken, must be determined by the state of the market and the demand for particular produce. The only certain rule, is, to ascertain the annual increase of timber in the tree, and determine thereby whether the value of that increase be equal to the annual interest of the sum the tree would bring, if felled, in addition to the charges of the land it occupies.

The following statement of the increase of trees at seventeen years of growth in the climate of Devonshire, on a porous soil, prepared by trenching, and planted in the most judicious manner, according to instructions by the Duke of Bedford, will show the comparative value of different species of forest-trees, as regards their property of affording early produce on a soil of the nature mentioned.

	Girt or Circumference at Two Feet from the Root. In.	Girt or Circumference at Seven Feet from the Root. In.
Popla	41	37
Larch	37	32¼
Pine	32¼	25¼
English elm	32	26
Silver fir	28¼	25
Spruce	27	22
Chestnut	27	22

* Well-authenticated facts relative to the comparative rate of increase of wood in the different species of forest-trees are much wanted. Without such facts, ascertained by careful and minute consideration of all circumstances influencing the growth of the trees, as soil, local climate, age, and culture, unerring or scientific principles cannot be obtained to guide the practical planter.

	Girt or Circumference at Two Feet from the Root. In.	Girt or Circumference at Seven Feet from the Root. In.
Birch	25	20
Sycamore	24	20
Beech	23	21
Oak	23	13
Ash	20	17

The heights of the trees were in full proportion to the girth, and the measurements are an average of the dimensions of six trees of each of the species respectively; there were numerous instances of individual trees exceeding any of the above in girth and length *.

Comparing the above with the former order of the rate of annual increase, the silver fir is found to be much lower in the rate of early produce in the first instance, but the genial climate in which the trees mentioned in the latter statement were cultivated will readily account for the discrepancy. In the higher grounds of Blair Adam before referred to, the silver fir is of slower growth than any of the trees mentioned in its early stages, but after that overtops them to a considerable height. The sweet chestnut, in the soil and local climate which thus rear the silver fir ultimately to such a high superiority, stands at the lowest point on the scale, while, in the more southern latitude and lower elevation, the chestnut takes precedence of the birch, sycamore, beech, oak, and ash. Local circumstances connected with soil, climate, and culture interfere with the idea of drawing general conclusions from these facts to be considered as data to guide the practical planter in every case; but to the valuer of plantations, which have only reached to their first stages of growth, these facts are of more extensive application, as showing the importance of estimating justly the effects of these agents in the progressive or annual rate of produce of timber in different species of forest trees.

The present value of a plantation is that which the market will afford for its produce at the time the valuation is made.

Prospective value is that to which the trees will attain at a remote period, or that to which they may arrive at full maturity, according to their respective species, and best fit the purposes for which they are most esteemed.

When a plantation is only of a few years growth, the value of the produce is too insignificant to be estimated, and the growth of the trees is often then so undeterminate as to render it difficult to calculate the ultimate results in this case; and when property is to be transferred, the cost of planting and the rent of the land occupied, with the sum of compound interest on the amount of these, must be taken as a just valuation.

When trees have reached to eight years of growth, their value is so small as to be below estimating; they will, however, by this time afford certain evidences on which to found calculations of their ultimate produce and value. Until trees have attained to a full timber size, the valuation of a plantation ought to proceed on the principle of prospective value. This includes, first, the number of years the trees will require to arrive at full maturity; secondly, the marketable value of the trees when at that perfection of growth; thirdly, the value of the periodical thinnings and of underwood. From the total amount of these sums must be deducted compound interest for the period the trees require to attain maturity; the remainder will represent the present transferable value of the plantation.

Thus on three and a quarter statute acres of a sandy soil, worth from five to twelve shillings per acre per annum when under pasturage, larch had

* Communicated by Mr. John Forester, at Endsleigh, Devonshire, from the Duke of Bedford's plantations.

been planted in 1810, and in 1826 it was desired to ascertain the prospective value of the plantation for 1851 *.

The trees amounted to 3311, of which 1000 were fit for fuel only, and required to be removed for the benefit of the healthy trees. The periodical thinnings being estimated every five years, this plantation would afford in

	Trees.		s. d.		£	s.	d.
1831, thinnings	600	worth	0 10 each		25	0	0
1836,	560		1 6		42	0	0
1841,	504		2 6		63	0	0
1846,	212		6 0		63	12	0
Underwood cut at three periods, including 1000 stunted trees, fit only for fuel					6	0	0
					119	12	0

Timber Trees standing in 1851.

			£	s.	d.
Largest sized trees 68, containing, on an average, each 30 feet of timber, at 1s. per foot			102	0	0
Second size	238	worth 10s. 0d.	119	0	0
Third size	129	do. 6s. 3d.	40	0	0
Total value of periodical thinnings, and of standing timber in 1851			380	12	0

Deductions.

Deductions for present payment.

	£.	s.				£.	s.	d.
Discount on	3	0	value of cuttings in	9	years	1	1	4
Ditto	3	0	ditto	9		1	1	4
Ditto	25	0	for thinnings in	5		5	8	3
Ditto	42	0	ditto	10		16	4	4
Ditto	63	0	ditto	15		32	14	0
Ditto	63	12	ditto	20		39	16	8
						96	5	11

	£.	s.	d.
Therefore prospective value as before	380	12	0
Deductions as above	96	5	11
Present or transferable value of the above plantation	284	6	1

From these details it will appear that an intimate knowledge of the habits of growth of the different species of forest-trees, and of the influence of soil and local climate on their periodical increase of timber, is absolutely required in the business of valuing plantations prospectively.

In settlements and divisions of landed property an accurate knowledge of the prospective value of all the plantations under full grown timber on the estates, is doubtless of great importance. The question of the comparative advantages and disadvantages of the occupation of land by forest-trees, and by corn and herbage, is one about which there has been much difference of opinion. There are those who contend that the former is

* The plantation in question formed a part of an extensive wood. From various causes, as the attacks of vermin, and the neglect of judicious culture, in suffering the natural produce of the soil to injure the young trees, and allowing trees of a more vigorous growth to injure those of a weaker, and partly also, from many of the plants having had an originally weak constitution, the failures had been considerable, but where the trees had escaped the effects of these evils, they had made good progress, and afforded evidence of future value as above detailed.

most advantageous, and others again argue, that for every purpose of private and public advantage, the latter is immeasurably superior. The truth lies between; for the fact is, neither of the two can profitably exist without the aid of the other, and the question becomes then narrowed to that of the proportions in which each should stand to the other. This point, however, has already been discussed as far as the limits of these pages permit, and it may be further only necessary to add, that the produce of timber in the United Kingdoms is very far from being sufficient to meet the demand for it. From a report of a select committee of the House of Lords, relative to the timber trade, made in 1820, it appears that the average quantity of foreign timber and deals imported into Great Britain during the four preceding years, amounted to 322,069 loads; the duty alone on which, in the last year of that average, 1819, amounted to 1,019,311*l.* 18*s.* 1½*d.* The statements of extraordinary profits from woodlands must be considered rather of a local than of a general interest; that of Lord Barham's chestnut plantation in Kent, which at nine years growth afforded a produce for hop-poles, which sold for 104*l.* per acre; a plantation of larch, for the same purpose, but on a soil not worth more than from 6*s.* to 7*s.* per acre, for cultivation, produced at the rate of 91*l.* per acre*. Of the willow, oak, &c. numerous instances of the like great profits might be adduced.

As a general estimate of the profits arising from forest-planting may not be uninteresting, the opinions of three professional planters of considerable experience on the subject are here mentioned.

Mr. Pontey of Huddersfield, the author of several esteemed treatises on planting, states, that from careful calculations of what might be reasonably expected from an acre of land suitable in itself, tolerably favourably situated, and in every respect well managed as a plantation of larch, the result is, a net profit—after paying for the rent of the land and every ordinary expense—of much nearer five than four hundred pounds in forty-two years.

Mr. Monteath, the well known author of the *Planter's Guide*, estimates the entire cost of planting, after the establishment of a nursery, at 22*s.* to 30*s.* per acre, with that of enclosing in large clusters, at about 10*s.* The periodical returns from an acre of larch only, after payment of the expenses of cutting, he calculates at from 5*l.* to 7*l.* at the expiration of the first ten years;

at least	. £25	ditto	second ditto.
	£300	at forty years growth.	

And assuming the average rent and annual charges on an acre of light sand adapted to the growth of larch to be 12*s.*, the amount of profit and loss will stand as follows:

	£.	s.	d.
Enclosing and planting . . .	2	0	0
Compound interest at five per cent. during ten years . . .	1	12	6
Charges at 12*s.* per annum, with compound interest at five per cent. for ten years . .	7	11	0
	11	3	6
Deduct the medium value of the first thinnings; *i. e.* 5 to 7 . . .	6	0	0
Balance	5	3	6

* Kent Report, p. 146.

	£.	s.	d.
Compound interest, at five per cent. on balance for ten years	3	4	6
Annual charges, with compound interest during ditto	7	11	0
	15	19	0
Value of thinnings at twenty years growth .	25	0	0
Profit per acre	9	1	0

Thus, according to this estimate, doubling the capital, with compound interest, in twenty years, besides leaving timber standing on the ground, which in twenty years more is calculated to be worth 300*l.*

Mr. George Sinclair, F.L.S., calculates, that the thinnings on an acre of land, of the value of from 5*s.* to 10*s.* per acre, planted with a mixed proportion of larch, beech, pines, hazel, birch, and oak—the latter with a view to the growth of navy timber, will, at the end of ten or fifteen years, according to local circumstances, repay the average expense of planting, rent, and management during that period, together with compound interest at five per cent.; and he estimates the clear profits of the future falls as follows:

In thirteen years, or at twenty-three years growth £24 10 0 per acre.
In thirteen years, or at thirty-six years growth 39 0 0 do.

And after that period a triennial profit of about 12*l.* per acre, until the oak left standing may be supposed fit for the naval yards, and worth at the present prices, 264*l.*, which leaves a balance superior in the proportion of 300 to 7 to the fee simple of the land*. But let it be remembered, that these calculations are all founded on the supposition of judicious planting and subsequent culture.

M. Chaptal† estimates the forests or woodlands of France to occupy about sixteen millions nine hundred and four thousand acres, or about one-seventh of the whole productive land of that kingdom. According to M. Herbiu de Halle, there are of forest lands belonging to

	Acres.
The State . . .	2,802,652
Crown . . .	164,565
Princes of the Royal Family .	479,348
Public Bodies . .	4,834,284
Private Individuals . .	8,623,555

The produce is estimated at five millions three hundred and forty-seven thousand pounds sterling, or about from six shillings and fourpence to seven shillings and fourpence per acre. Compared to this of woodland, the production of arable land is estimated at ten shillings, and grass land is placed on a level with that under the vine, *viz.* thirty-three shillings and eightpence an acre‡.

* These calculations were made at the same time by the three individuals mentioned, but unknown to each other: and as the results agree in all material points, except as regards the cost of planting in the second statement, which is very low, the general conclusion receives much weight.—*Prospectus of British Forest Planting*, 1826.

† *Journal des Forêts, tome premier. A Paris*, 1829.

‡ 'Les *prés* sont placés sur la même ligne, malgré le proverbe populaire qui dit que la vigne rachète le pré.'—*Ibid.*

G 2

The royal forests of Britain occupy about 125,000 acres of land *; but of these the greater portion are subject to claims of various sorts for common of pasture, turbary, &c. There are 32,768 acres of forest-land enclosed and planted principally with oak, and with other trees where the soil is not adapted to oak. Of these 13,700 acres may be laid open when

* A Return, showing the number of acres in each of the Royal Forests, distinguishing the open commonable lands, and the lands appropriated to the growth of timber, in each forest; also, the number of acres of other lands, the property of the Crown, appropriated to the like purpose.

Name of the Forest.	Contents.	Open commonable Lands.	Lands appropriated for the growth of Timber.	Remarks.
	Acres.	Acres.	Acres.	
New Forest, in the county of Southampton	66,678	60,678	6,000	Subject to rights of common, the inclosed lands to be thrown open when the trees are past danger of deer or cattle, when an equal quantity may be inclosed out of the waste in lieu of what shall be restored to common.
Dean Forest, in the county of Gloucester	21,473	10,473	11,000	
Woolmer Forest, in the county of Southampton	5,949	4,249	1,700	
Waltham Forest, in the county of Essex	3,278	3,278		Subject to rights of common.
Alice Holt Forest, in the county of Southampton	1,892		1,892	The property of the Crown in fee.
Bere Forest, in the same county	1,417		1,417	
Salcey Forest, in the county of Northampton	1,285		1,285	
Windsor Forest, in the county of Berks	4,402		4,402	
Delamere Forest, in the county of Chester	4,641		4,641	
Parkhurst Forest, in the county of Southampton	900		900	
Whittlewood Forest, in the county of Northampton	4,500	1,122	3,378	517 *a.* 3 *r.* 31 *p.*, the property of the Crown in fee remainder, subject to rights of common; the inclosed lands in this and in Whichwood Forest consist partly of coppices, which are by law thrown open to deer and cattle at the end of 7 or 9 years from the time when first inclosed, and at which period the young trees are not past danger of deer and cattle, and are, in consequence, in a great measure, destroyed.
Whichwood Forest, in the county of Oxford	3,709	1,808	1,841	Subject to rights of common.
Other Lands appropriated for the growth of Navy Timber.				
Freehold lands in New Forest, in the county of Southampton			974	
Do. in and adjoining Dean Forest, in the county of Gloucester			3,708	
Do. do. Woolmer Forest, in the county of Southampton			183	
Do. do. Bere Forest, in the same county			132	
Woodlands at Eltham, Gillingham, &c. in the county of Kent			1,000	
Parcels of the Crown Estate at Chopwell, in the county of Durham			896	
Uninclosed Lands, arising partly from inclosures thrown open, and partly from woods of spontaneous growth, which are so stocked with trees as to be reckoned in the quantity of productive timber, estimated at about			7,500	
Lands now appropriated for the growth of Timber			52,850	

An

the trees are past danger of deer or cattle; and an equal number of acres to those thus laid open, may be enclosed and planted. The remaining 14,068 acres belong to the crown in fee, and will always be kept enclosed. There are 6211 acres of other freehold land belonging to the crown, which are also appropriated to the growth of timber, making in all 38,979 acres, the whole of which have been enclosed and planted within the last twenty years. In New and Dean forests, Hainault forest, Whittlewood forest, and Wychwood forest, there are open woods or coppices of considerable extent, containing trees of all descriptions, from ship timber down to saplings; but the number of acres so covered, or the number of trees occupying the surface, appear to be unknown.

The soil of the royal forests of Britain contain almost every variety of soil,—deep strong clay, rich deep loam, light loam on freestone gravel, bog, &c. The quantities of these different soils should be estimated. It is quite true that a field of ten acres may contain two or three different varieties of soil; but that is no substantial reason for not classifying the quantities on which to found a practical plan of management, so as to obtain the largest and speediest return of produce of the best quality, and that every portion of the land be occupied to the best advantage. Without an estimate of the spaces of the different soils, no accurate calculation can possibly be made of the produce the lands in question ought to and would afford under the most judicious culture; and consequently there is no check whatever to the practical management, but that of vague opinion.

As the most judicious, because the most profitable and certain in the result of obtaining the largest quantity of timber of the best quality in the shortest space of time, on a given space of land, the preparation of the soil for the reception of the plants by paring and burning the surface, afterwards trenching, and manuring when possible, and taking from the soil thus prepared an ameliorating fallow crop the season before planting, has been urged at pages 22, 27, and 39, as a general principle of culture for the soils of the nature specified. But if this mode of culture be therefore so superior as it is proved to be for planting lands under ordinary freehold tenure, how much more beneficial, or rather essential, must the adoption of it be in cases such as of those belonging to the crown, where the rights of common render it imperative to open the fences of the young plantations to stock or to sheep and deer in seven or nine years from the period of planting. The trees so cultivated will in that period be comparatively out of danger, and the ultimate object, that of timber of the best quality the soil is capable of rearing, secured. But besides these advantages, that of affording profitable employment to labourers out of work, in the parishes adjoining the lands in question, and at a season of the year when labour is most scarce, cannot but add powerfully to the reasons, sufficient of themselves, already offered on this head; besides the valuable example for imitation by the public which the Government would, in this important branch of rural economy, afford, and by it encourage those

An account of the quantity of land, cultivated and waste, in the British Dominions, including Scotland and Ireland, and the British Isles, according to the evidence of Mr. William Cowling, before the Emigration Committee, in 1827.

	Cultivated acres.	Uncultivated acres.	Unprofitable acres.	Total.
England . . .	25,632,000	3,451,000	3,256,400	32,342,400
Wales . . .	3,117,300	530,000	1,105,000	4,752,000
Scotland . . .	5,265,000	5,950,000	8,523,930	19,738,930
Ireland . . .	12,125,280	4,900,000	2,416,664	19,441,944
British Islands .	383,690	166,000	569,469	1,119,159
	46,522,970	15,000,000	15,871,463	77,394,433

who may possess waste or unproductive land to plant it, for a present benefit to the unemployed labourer, and as an accumulating capital for the younger branches of his family and posterity, as well as for the general good of his country.

The following statements will shew that the cost of preparing the different soils of the nature and properties described at pages 48, 49, and 50 of this Essay, and numbered 3, 4, 5, 6, for planting forest-trees in the best manner, that is to say, by paring and burning the coarse surface, trenching, draining, and manuring when expedient, and afterwards taking a green fallow, or ameliorating esculent crop as a precursor to the forest-tree plants, will be repaid by a judicious choice and culture of the kind of crop best adapted to the soil, and the produce of which is in a greater local request. It may be perhaps unnecessary to observe here, that the nature of different varieties of soil, comprehending their texture, chemical properties, the nature of the subsoil or mineral stratum on which they are incumbent, and their local climate and site, have all a great and active influence in determining the probable cost of the culture of the crops best adapted to be raised or cultivated upon them.

The local demand for the produce of particular species of husbandry crops have also a considerable influence on the comparative marketable value of these crops: hence it is impracticable to make a perfectly clear comparative estimate of value of different crops in the present case applicable to every different soil, unless those different circumstances alluded to under which each is placed were accurately known; but which, under ordinary circumstances, may be readily ascertained in the locality. The potato, Swedish turnip, cabbage, carrots, mangel worzel, khol rabi, tares, or vetches, &c., have each a superior local value, according to circumstances, besides that of their absolute or intrinsic value generally, as crops in husbandry. We may take the first-mentioned crop, therefore, as an example, its culture, comparative value as a fallow-crop, and the marketable value of its produce being, perhaps, more generally understood than that of the others. The soil is, taken of a second-rate quality, worth a rent of from fifteen to twenty shillings per acre.

	£.	s.	d.			
Paring and burning	1	16	0			
Trenching	4	0	0			
Draining or grubbing up	0	15	0			
Potato sets or seed, 16 bushels at 1*s*. 6*d*.	1	4	0			
Planting, ditto	0	16	0			
Hoeing and earthing up	0	16	0			
Reaping	1	10	0	£10	17	0
Produce						
6 tons of potatoes from a virgin soil, prepared by paring, burning, and trenching, at 44*s*				13	4	0
Balance remaining				2	7	0

after preparing the soil in the best manner for planting, to go towards paying the purchase of plants and planting, as in the case of lands belonging to the crown, or, in other cases, towards the charges of rent, interest of capital laid out in fencing, payment of tithes, taxes, and other public imposts.

The above mode of preparing the soil would afford seventy-three days work an acre to labourers, at two shillings a day, chiefly in that portion of the year when labour is least in demand, viz., from the middle of September until April. Were fifty acres set apart every year on an average from each of the royal forests, and planted according to the plan now recommended, there being twelve royal forests situated in the counties of Southampton, Gloucester, Essex, Northampton, Berks, Chester, Oxford, Durham, and Kent, labour or work alike profitable to the unemployed and to the country would thus be given to six hundred men in the parishes and neighbourhood in which such lands are situated. The profitable results, as regards the attainment of the principal object in view, viz., timber of the best quality the soils employed are capable of affording, and that in the largest quantity on a given space of land, and in the shortest period of time, have already been discussed and shewn to follow the mode of culture described.

There is stated to be but one-sixteenth part of the timber used at the royal yards supplied by the extensive forests of the crown, the other fifteen-sixteenths having to be purchased from private estates, and from abroad. There is good reason to believe the planting and rearing of oak and of hard wood in general have not kept pace in England with the consumption of that article. The policy of depending on foreign countries for an article of such paramount importance as that of timber for naval and civil architecture, need not be discussed in these pages. But let us consider, however, whether the forests abroad are always to remain unexhausted for our demands, or the supply of our wants herein, while the neglect of planting continues;—we believe not; and that other countries will, at no very distant period, be in the condition that the North American states now are, as regards the supply of timber from their natural forests. That condition is described by an accurate observer, A. H. Hillhouse, a citizen of the United States, and the translator of Michaux's 'North American Sylva.' His words are, 'Though three-fourths of our soil (North America) are still veiled from the eye of day by primeval forests, the best materials for building are nearly exhausted. With all the projected improvements in our internal navigation, whence shall we procure supplies of timber fifty years hence for the continuance of our marine? The most urgent motives call imperiously upon government to provide a seasonable remedy for the evil: from a government like ours, which is a faithful expression of the public will, and which has no concern but the prosperity and honour of the nation, and from which prospective wisdom is reasonably demanded.'

It is observed by Mr. Loudon, in his Encyclopædia of Gardening, that in planting, as in every other branch of culture, extraordinary profit is attended by extraordinary production, which soon sinks the market value of the article; and also, that in a commercial, free, and highly taxed country, whenever any article attains a very high price, substitutes are found at home, or imported from abroad, so that no particular crop should be considered the best to cultivate without exception, nor extraordinary profits calculated prospectively on any crop whatever.

This opinion, however just, as applied to annual or biennial crops, is but slightly applicable to forest planting, and, indeed, not at all as regards the planting of waste or inferior soils, because, as before stated, the value of a crop of timber or of a forest plantation depends not alone on the relative or positive worth of the timber itself, as is the case with the kinds of crops alluded to, but also greatly on the circumstances of improving the climate and the soil of the adjoining lands, fitting them for the growth of

the more valuable husbandry crops, and the rearing and fattening of the more valuable domestic animals, which, without the aids that judicious forest-planting confers, would be withheld, and the land continue waste and unprofitable to the owner and to the nation.

The high perfection to which some individual trees of the different species have attained, is an object of much interest to the profitable planter of forest-trees as well as to all; for who does not derive pleasure of the highest order from the contemplation of woodland scenery? The limits of these pages admit but of a few short notices on this point.

The oak which was felled in April, 1791, in the park of Sir John Rushout, Bart., at Northwich, in Worcestershire, and judged to be about three hundred years old, and perfectly sound and fine timber, measured

	Feet.
In circumference, or girt, at five feet from the ground .	21
Smallest girt	18
Length to the branches	30
Solid contents of the body	634
Estimated timber in the arms	200
Cubic feet of timber . .	834

The celebrated Fairlop oak, in Hainault Forest, Essex, is stated to have measured at three feet from the ground about thirty-six feet in circumference, and the extremities of the branches gave a circle of three hundred feet.

In Welbeck Park an oak is mentioned as one hundred and eleven feet in height, seventy feet up to the branches, and the circumference at the bottom twenty-one feet.

In Holt Forest, near Farnham, an oak in 1759 girted thirty-four feet at seven feet from the ground; in 1778, or in nineteen years, it had increased only half an inch.

At Oakley, in Bedfordshire, the seat of the Marquis of Tavistock, there is an oak now in perfect health, which contains about five hundred and twenty-seven cubic feet of timber, and the branches overspread a space of five thousand eight hundred and fifty superficial feet of ground.

Mr. Rookes, in his account of the oaks of Welbeck, mentions that an oak cut down in Birchland, had the letters I. R. more than a foot within the tree, and about a foot from the centre. It was supposed to be two hundred and ninety-two years old. It was perfectly sound, and measured about twelve feet in circumference.

The oaks in Woburn Park have already been alluded to as being trees of remarkably fine growth. There is one situated in the park, to the east of the Abbey, which measures ninety feet in height, the main stem of which is fifty feet, and head above the forks forty feet. This tree contains four hundred and ninety-two cubic feet of timber. The circumference at four feet from the ground is fifteen feet two inches.

There is another fine oak, in perfect health, which contains six hundred and sixty-six cubic feet of timber, on the west of the Abbey. The circumference near the ground is thirty feet, and the height to the boughs sixty-six feet. Four of these oaks measures two thousand and sixty-eight cubic feet of timber, after deducting one-eighth, the allowance for the bark. The variety of oak in this park is chiefly of that called the foot-stalked oak, *Quercus robur pedunculata.*

The elm may be placed next to the oak for utility and ornament. The wych elm is the most hardy. There is one mentioned by Evelyn in Sir Walter Bagot's Park, in Staffordshire, which measured forty yards in

length, and at the stool seventeen feet in diameter. The weight was estimated at ninety-seven tons.

The chestnut (Castanea vesca) may dispute the order of precedence with the elm, but that it is less hardy, and requires a milder climate, and more genial soil. On the banks of the Tamar, in Cornwall, there are some of the finest specimens of this tree. A very remarkable tree of this kind in England is at Tortworth, in Gloucestershire. A figure of it is given in the Gentleman's Magazine for 1766, p. 321. The age of this tree is supposed to be upwards of one thousand years. In 1791 it measured forty-four feet four inches in circumference. The soil in which it grows is described as being a soft loamy clay.

The finest tree on record of the beech appears to be that in Woburn Park, situated on a rising ground south of the Abbey, in a fine grove of that species of tree. The height of the tree at this period is one hundred feet. It has a clear and nearly equally cylindrical stem of the height of fifty feet, and the top, which is of the most graceful proportion in every respect, occupies fifty feet in height. The solid contents are four hundred feet. The soil in which this remarkable tree grows has already been described at p. 48.

Of the larch (Pinus larix), the finest specimens have been produced in the extensive woods of the Duke of Athol, at Dunkeld, in Perthshire. One tree of fifty years of age measured eighty-six feet and a half in height, and contained eighty-two feet of solid wood. There are instances of the larch attaining to upwards of one hundred feet in height, and of twelve feet in circumference.

The specimens of the silver fir (Pinus picea) at Blair Adam before mentioned are remarkable for size and symmetry; but the finest specimen, perhaps, in Britain grows in Woburn Park. The height of this tree is one hundred and ten feet, and the circumference at four feet from the ground, ten feet six inches; the solid contents or cubic feet of timber contained in it being three hundred and seventy-five feet. The age of the tree is about one hundred and ten years, and the average increase of height has, therefore, been exactly one foot every year, and the periodical produce of timber upwards of three, or nearly three and a half, cubic feet per annum. This appears to be the largest periodical increase of timber, continued for so many years, that is recorded.

Three black Italian poplars, planted by the present Duke of Bedford in 1806, are now of twenty-three years growth, and measure as follows:—

		Feet.	Inches.	Solid Contents.
No. 1.	Height . . .	31	0	60 feet.
	Circumference or girth .	6	7	
	The stem at fifteen feet $\frac{1}{4}$ girt,		$19\frac{3}{4}$ in.	
	Ditto at sixteen feet above $\frac{1}{4}$,		$13\frac{1}{4}$ in.	
No. 2.	Lost its top in a blast in 1828.			
	Measures—Height .	23	0	45 feet.
	One-fourth girt . .	$16\frac{3}{4}$	0	
No. 3.	Height . . .	26	0	46 feet.
	One-fourth girt . .	0	16	

These trees were planted on a light soil, but well prepared by trenching.

The products of plantations have already been incidentally mentioned. The terms used by practical men to denote these products are not the same in all places, but frequently the same term is used in different counties to mean different products, and sometimes a term used in one place is totally unknown in another. As in legal instruments, relative to the transfer or holding of woodlands, the misunderstanding of these terms has

not unfrequently been the cause of serious inconvenience, it may be of use, therefore, to enumerate these names and synonyma.

Butt-end.—That portion of the stem of a tree which is situated nearest to the root.

Bush, in gardening and planting, applies exclusively to every perennial ligneous plant (mostly with several stems from its root), which in its natural state seldom attains to a timber size, *e.g.* having a stem *girting* six inches. We understand currant-bush, gooseberry-bush, rose-bush, holly-bush, laurel-bush, &c., but never oak, elm, or ash-bush, &c. The limits between a shrub or bush and a tree cannot be more precisely defined than by the girt or diameter of the stem, under ordinary circumstances of culture, never attaining to, or exceeding the above dimensions.

Bavins.—House-faggots, bound with two withers or weefs, chiefly used by bakers for the oven.

Binders.—Long pliant shoots of hazel, ash, &c., which have pliancy and length enough for binding down newly-plashed hedges, making close fences round rabbit-warrens, sheep-folds, hurdles, and binding faggots.

Bole.—The stem, trunk, or body of a tree, after it has attained to upwards of eight inches in diameter, or to that size which constitutes timber. Vide *Timber.*

Cane, Smart-hoops.—Shoots of the hazel, six feet in length; they are cleft for hoops, and are used by sugar-refiners for their earthen pots; also for salmon kits, small tubs, and other purposes of the cooper.

Cion, scion.—Properly a shoot one or two years old, or a cutting of a branch of that age for the purpose of grafting. Used sometimes to denote the shoots of a coppice stool. (Worlidge.)

Coopers' ware.—The lower ends of ash poles cut from six to eighteen feet long, according to the length of the shoot. They are cleft for the use of the cooper, waggon-tilts, &c.

Dead woods.—The same as *kiln-faggots*, which see.

Edders, Roders.—The same as *binders*, which see.

House-faggots.—The long branches of the hop and fence poles. The tops of hedge-stakes, coopers' ware, &c., bound with one *wither* or *wef.* Vide *Bavins.*

Kiln-faggots.—The lowest product of a plantation, being made of the brushings of the wood previous to the commencement of cutting the copse, and are made of brambles, dead-wood in the stubs, and refuse of plants on the surface of the ground; used for burning lime, bricks, &c.

Girt, girth, of the *bole*—Is sometimes understood as the circumference of the stem, but more generally as the fourth part of the circumference or side of the square of the stem. Gilpin (in 'Forest Scenery,' vol. i. p. 59 and p. 141) uses it in the former sense, when he says, 'at Wimly, near Hitchin Priory, Herts, a chestnut-tree, in 1789, girted somewhat more than fourteen yards.' He could not mean the tree to square forty-two feet in the side. Grose also appears to use the term *girt* in the same sense, when speaking of the limb of a chestnut-tree at Fortworth, in Gloucestershire:—'One limb measured twenty-eight feet and a half in girt, five feet above the crown.'—*Philosophical Account*, p. 176. Of the same tree he says the stem 'girted fifty-one feet at six feet from the ground.' And Professor Martin quotes from an inscription placed under an etching of it, stating that 'the tree measures nineteen yards in *circumference*,' which sufficiently proves 'the sense in which the word 'girt' is understood by the above. The word girt is doubtless derived from girth, *quasi*, to gird or encompass, notwithstanding its general acceptation is to denote the fourth part only of the circumference, or side of the stem when squared.

Log.—The trunk or body of a timber-tree prepared for the sawyer.

Maiden-plant.—A young tree raised from seed, in opposition to one produced from an old root or stub.

Moot, in Devonshire, is the same with stool in other counties. Vide *Stool.*

Nascent stem.—The development of the stem of a seedling plant, just previous to the exhibition of the first leaves.

Poles.—Shoots from coppice-stools on the stems of young trees of various lengths, according to the purpose for which they are wanted; those for hops should be from ten to eighteen feet long.

Red-hearted.—A discoloration of the central point or heart-wood of a tree, most frequently arising from bad management in the early culture of the tree, by neglecting to prevent or remove every cause of *stunting* the growth in the earliest stages of culture. An ungenial soil produces this defect likewise.

Sapling.—A young tree under six inches diameter at four feet from the ground; in some places it is used to denote a young tree raised immediately from the seed, which is then termed a maiden-tree; in others it is considered a young tree, the produce of a coppice-stool, old root, or stub, and, by a few, a long young tree, the produce of either.

Sears, or low faggots.—Made similar to bavins (which see), but longer, and generally bound with three withs: used for sheltering farm-yards, hovels, and for various other purposes.

Fall cutting.—A term used to denote the period of cutting a copse, which varies from twelve to eighteen and thirty years, according to the soil or produce of the coppice, and the judgment of the proprietor.

Shaky—shakes.—The fissures, cracks, or longitudinal openings often found in the timber of trees which have suffered from injudicious culture and an ungenial soil, vide p. 73.

Shoot.—Indifferently used for the young, lateral branch of a stem, or that of a coppice-stool or stub.

Sprig of wood.—In some instances understood as the branches of a tree. Vide *act.*

Standard.—The shoots of a coppice stool, selected from those cut down as underwood to remain for large poles or timber-trees.

Slivery.—Small, straight shoots of large ash, &c., cleft into hoops for the purposes of the cooper. Vide *Cane and Coopers' ware.*

Stem.—The body of a tree in all its stages of growth, from a seedling to that of a full-grown tree. See *Bote.*

Stole.—The first stage of growth of a shoot emitted or sent out from the sides of a root or stub or coppice-stool. See *Tiller.*

Stool.—The root of a tree which has been left in the ground, the produce of another tree, or shoot for saplings, underwood, &c.

Stub.—See *Stool.*

Sucker.—Properly the young plants sent up by creeping-rooted trees, as in the poplar, elm, &c. These suckers are oftentimes very troublesome, under the circumstance of their often appearing in lawns, or grass fields near a mansion. The term sucker is also applied in some places, to denote the side shoots from a stool or stub. See *Stool.*

Tap-root.—The first root produced by the seed of a tree, which descends at first perpendicularly into the earth, and supports the plant until the proper leaves are produced, which, in their turn, assist in the production of fibres or proper roots.

Tellow.—See *Tiller.*

Tielar.—See *Tiller.*

Tilar.—See *Tiller.*

Tiller, or *Tellar,* a shoot selected for its superior strength and healthy habit from those produced by a coppice-stool to stand for a timber-tree, or for maiden bark, if an oak, to stand for the space of two or three falls.

Timber.—When the wood of a stem or branch of any species of plant attains to the dimensions of 24 inches in circumference, or upwards of eight inches in diameter, it is termed *timber.* Those plants whose wood never, or but seldom, attains to the size now mentioned, come under the denomination of shrubs or bushes, poles, &c. Hence the popular distinction between *tree* and *shrub* or *bush.*

Here it may be proper to state the usual mode of determining the quantity of timber in trees. The customary method of measuring timber is by *girting* the piece in the middle, *i.e.* from the *butt-end* or root to the top, where it terminates, at 24 inches in circumference. The mean between these two points affords the nearest average of the circumference or diameter. The fourth of this circumference, squared and multiplied by the length, gives the contents. Thus suppose a stem or bole measures $75\frac{4}{10}$ inches in circumference, or 24 inches in diameter, and 15 feet in length: *then* $75\frac{4}{10} \div 4 = 18\frac{8}{10} \times 18\frac{8}{10} =$ 2ft. 5.5 $\times$ length 15ft. = 36ft. 9.3 in. But by taking $\frac{1}{5}$ of the circumference and twice the length, the result is more accurate, thus—$75\frac{4}{10} \div 5 = 15$; then $15 \times 15 \times$ 30ft. = 46ft. 10.6. But it need hardly be remarked that neither the fourth nor the fifth of the circumference can be used to determine accurately the cubic contents, although in common practice the first is considered sufficiently so. The nearest approach to the truth of the contents is to multiply the square of the circumference of the stem by its length, and that multiplied by .07958 will give the number representing the solid contents, thus—$75\frac{4}{10} \times .079574 \times$ 15ft. = 47 1.5. Or square the diameter thus,—$24 \times 24 \times .7854 \times 15 =$ 47 1.5. But whatever mode of measurement and calculation be adopted, an allowance must be made for the thickness of the bark. Different species of trees differ much in this respect, and the age of individuals of the same species differ likewise, according to the age of the tree. It is customary in the oak, elm, and trees having a rough bark, to deduct at the rate of one inch for every foot of quarter girt, that is, if the circumference is four feet, the quarter girt is one foot or 12 inches, and the allowance for the bark will reduce it to 11 inches. Less than one foot quarter girt down to six inches, the allowance is made at the same rate, and so for any increase above the example quoted. In ash, and other trees having a thin bark, the allowance is half an inch for every foot of quarter girt. In Scotland, according to Mr. Monteath, the rule is to allow for bark two inches in circumference from 12 to 24 inches; three inches in a circumference of from 24 to 36; from 36 to 48, four inches; from 48 to 72, five inches, and above 72 inches in circumference, to deduct six inches.

Trunk.—The body or stem of a forest-tree. See *Bole.*

Withers or *weefs.*—The pliant shoots of hazel, ash, willow, &c., for binding the spray and prunings of trees into faggots, brooms, &c. See *Binders.*

Chapter VIII.

Enumeration of the different species of Forest Trees.

In the following list the trees are arranged in the order in which they are supposed to stand in natural alliance with each other; but being a selection from the whole vegetable kingdom as regards one property, only that of producing timber in the climate of Great Britain, there will be found therefore great breaches in the natural connexion between many of the individuals comprising a list so formed; and on this account, and the want of space, as well as that the Linnean botanical descriptions are equally efficient in distinguishing one family of plants from every other, and different species of plants from each other, the Linnean descriptions only are given.

MAGNOLIACEÆ.

Polyandria Poly. Linn.

Eng. Name.	Bot. Name.
Cucumber-tree or Magnólia.	Magnólia.

Generic Character—*Calyx*, three-leaved; *petals*, nine; *capsule*, two-valved, imbricated; *seed*, berry, pendulous.

Time of sowing seed—as soon as it can be procured from abroad. Sow in pots filled with a mixture of loam and peat, and plunge them into an old hot-bed of tanner's bark. They may also be propagated by layers.

Uses—Veneering, the purposes of the turner, and those of timber in general for in-door works.

Species for Ornament, Shelter, or Underwood.

Magnolia. Cucumber-tree.		Native of	Ft.
Umbrella-leaved	*tripĕtala*	N. Amer.	30
Bluish flowered	*acumináta*	——	25
Heart-leaved	*cordáta*	——	—
Great flowered	*grandiflora.*	——	60-70
Long-leaved cucumber-tree	*auriculata*	——	20
Large-leaved	*macrophýlla*	——	30

Magnólia grandiflóra. Big laurel and largemagnolia of America, and laurier tulipier of the French, is first seen in North Carolina, near the river Nuse, in the latitude of 35° 31′; and proceeding from this point, it is found in the maritime parts of the southern States and of the Floridas, and as far up the Mississippi as Natcher, 300 miles above New Orleans, which embraces an extent of 2000 miles. According to Michaux, the *magnólia grandiflóra* claims a place among the largest trees of the United States, as it sometimes reaches ninety feet in height and two or three in diameter, but its ordinary stature is from sixty to seventy feet. Its trunk is described as being commonly straight, and its summit nearly in the shape of a regular pyramid. The same author observes, that they who have seen this tree in its native soil, blooming with its large white fragrant flowers disposed amidst the rich foliage of the tree, agree in considering it one of the most beautiful productions of the vegetable kingdom. In Carolina it blossoms in May, and the seeds are ripe about the beginning of October. The wood is soft, and remarkable for its whiteness, which it preserves even after being seasoned; it is said to be easily wrought, and not subject to warp, but that it is not durable when exposed to the weather; for this reason the boards of the *magnólia grandiflóra* are used only in joinery in the interior of buildings. In its native climate it grows only in cool shady places, where the soil is composed of brown mould, and is loose, deep, and fertile. The seeds preserve their vegetative powers several months out of the ground. A single tree sometimes yields four hundred cones, each of which contains from 40 to 50 seeds. The most northern point which this tree passes the winter in the open air, is about Nantes, in lat. 47° 13′, but it begins to bear ripe fruit about Grenoble, in lat. 45°. In a garden near Philadelphia, Michæux saw a tree of this species, which bore uninjured the rigorous climate of this part of Pennsylvania, which is much more severe than that of Paris or London. In England the *magnólia grandiflóra* is more injured by being

planted in an ungenial soil than from the severity of the climate. The fact is, the soil should be that above described, but not an insulated portion, as is mostly the case in practice, by digging a hole and supplying it to the plant merely to that extent, whereas it should be general over a large extent of surface, so as to effect the atmosphere by its peculiar exhalations, thus acting on the leaves as well as on the roots. The *magnolia grandiflora* was introduced into England about 1731.

Magnólia gláuca.—This tree is found common in Lower Jersey, but is also found in latitude 45° 50′, near Cape Anne, in Massachusetts, N. America. In the Carolinas and in Georgia it does not ordinarily exceed twenty or thirty feet, although it sometimes attains to forty feet in height. At New York it yields fruit at the height of five or six feet. The wood is not considered to be of any value in building. The flowers are flagrant, and the bark of the roots has an aromatic odour and a bitter taste. The country people in Lower Jersey drink an infusion of this bark in brandy as a remedy in rheumatic affections, and an infusion of the cones in whiskey is regarded by them also as a preventive against autumnal fevers. (Michaux, 11.) This tree appears to have been introduced into England in 1688.

Magnólia acumináta is common in all parts of the United States of America, where it is generally known under the name of the cucumber-tree. Its stature is similar to the magnolia grandiflora, rising to sixty or seventy feet, and sometimes even as high as ninety feet. It is found as far north as the 43rd degree of north latitude, near the celebrated cataract of the Niagara river. The inhabitants of the countries bordering on the Alleghanies gather the cones about midsummer, when they are half ripe, and steep them in whiskey; a glass or two of this liquor, which is extremely bitter, is a preservative against autumnal fevers: on this Michaux remarks, that though he does not deny the efficacy, the remedy has not been made sufficiently evident to induce any physician to attempt its verification. In its native soil, Michaux describes the trunk as perfectly straight, of an uniform size, and often destitute of branches for two-thirds of its length, the summit ample, and regularly shaped; the flowers are five to six inches diameter, of a bluish white, having a feeble odour, but as they are so large and are numerous, they have a fine effect in the midst of the super-foliage. The wood is soft, and like that of the poplar, is fine grained, and susceptible of a brilliant polish, but it is neither strong nor durable when exposed to the weather. In England this tree is perfectly hardy, and attains to a considerable size. Introduced into England in 1736.

Magnólia cordáta, heart-leaved cucumber-tree, in its native soil of the banks of the river Savannah in Upper Georgia, and those of the streams which traverse the back parts of South Carolina, attains to forty and fifty feet in height, and from twelve to fifteen inches in diameter. The leaves are from five to six inches in length, and from three to five in width; the flowers, which appear in April, are yellow, and are nearly four inches in diameter. The wood is of no determinate use, but the tree is very hardy and ornamental in parks. Introduced into England in 1801.

Magnólia tripétala, umbrella-tree, is found in soils deep and fertile in the northern parts of New York, and is common on some of the islands of the river Susquehanna. Near the great swamps of South Carolina and Georgia it is almost invariably accompanied by the magnolia grandiflora and swamp chestnut oak. It is of humbler growth than the magnolia grandiflora, seldom attaining to thirty or thirty-five feet in height, with a diameter of five or six inches. The leaves are eighteen or twenty inches long, and seven or eight broad; the flowers are white, and seven or eight inches in diameter. The fruit is four or five inches long and two inches in diameter. The wood is light and porous, and unfit for use. The tree is highly ornamental and very hardy. Introduced into England in 1752.

Magnólia auriculata, long-leaved cucumber-tree, is equally remarkable with the magnolia tripetala, for the beauty of its foliage and the size of its flowers, which are also of an agreeable odour, and is found, Michaux observes, only in a small tract far retired in the

country, at the distance of 300 miles from the sea, on a part of the Alleghany mountains. In its native soil it attains to forty or forty-five feet, and a diameter of twelve or fifteen inches. The leaves are of a light green colour, of a fine texture, eight or nine inches long, and from four to six inches broad; the base of the leaf is divided into rounded lobes, whence the name ear-leaved. The flowers are white, and from three to four inches diameter. The wood is light and spongy, and unfit for the purposes of the carpenter. The bark is stated to have an agreeable aromatic odour, and an infusion of it in ardent spirits is employed as an excellent sudorific in rheumatic affections. It is a hardy tree, and very ornamental for parks. Introduced into England in 1786.

Magnólia macrophy'lla, vel *Michauxii*, large-leaved cucumber-tree, is more remarkable for the superior size of its leaves and flowers than any other species of this genus. It resembles most the magnolia tripetala in its general habit of growth, and it is generally found growing in company with it. The leaves are sometimes thirty-five inches long, and nine or ten inches broad. The flowers are white, fragrant, and larger than those of any other species of magnolia, being sometimes eight or nine inches in diameter; the buds are compressed, instead of being rounded at the end, as in the magnolia tripetala, and they are covered with a soft and silvery down: this circumstance affords a ready distinction between these species at that season when the flowers and leaves are absent. The wood is of an inferior quality. The tree is highly ornamental. In its native soil, according to Michaux, it grows to the height of thirty-five feet. Introduced into England in 1800.

The other species of magnolia or cucumber-tree in the gardens of England, come at present, or as far as experience of their habits in this climate indicates, exclusively under the head of ornamental plants or shrubs, and consequently they are omitted in this enumeration.

TULIP-TREE. LIRIODENDRON.

Calyx, three-leaved; *petals*, six; *seeds*, into a strobule, or cone.

Time of sowing seed—spring. *Soil*, light earth, to be shaded from the heat of the mid-day sun.

Uses—The wood is esteemed for its lightness and durability, and in the western states of North America it is used as a substitute, in building, for the wood of the pine. The inner bark of the branches and root is used as a substitute for the Peruvian in remittent and intermittent fevers. It delights in a light rich loamy soil. It has been known to measure 22 feet in circumference, and to rise to 120 feet in height. Introduced into England in 1688.

Species for Ornament, Shelter, or Underwood.

Common.......*tulipifera*..N. Amer. ..60
Var. Entire lvd. .*integrifolia* —— —

TILIACEÆ.

Polyandria Polygynia. Linn.

Trees of the habits and general appearance of the common Lime or Linden-tree.

LIME-TREE. TILIA.

Calyx, five-parted; *corolla*, five-petaled; *capsule*, coriaceous, globular, five-celled, and five-valved, opening at the base; *seed*, one or two in each cell, roundish, covered with a coriaceous globular-shaped capsule, which has five valves, five cells, and opening at the base.

Time of sowing seed—Autumn, in a shady border of moist, light soil; but the usual mode of propagation is by layers. *Soil*—in almost any kind of soil, if moderately damp.

Uses—The wood is light, delicately white, and of an uniform texture, useful for some domestic purposes, and for those of the carver. Gibbon's inimitable carvings of flowers, dead game, &c., were of this wood, Br. Fl., vol. iii. p. 18. The bark of this, and probably of other species of lime, makes the Russian mats called *bast*. As an ornamental tree, the lime is esteemed for the fragrance of its flowers, of which bees are very fond.

Mr. Boutcher says, at eleven years old the plants will be twenty feet high; and at sixteen years old, from thirty to thirty-five feet high. The common yellow twigged lime, called also linden tree, and smooth-leaved lime, was formerly more than now a great favourite with planters. Whether it be properly a native of Britain, seems

to be uncertain, but that it has been long naturalized in this country is certain. A lime tree is described by Dr. Turner as growing near Colchester, which must have been cultivated in England before 1562. Du Hamel states that the French, in the reign of Louis XIV., growing tired of the horse chestnut, adopted this tree; and Sir James Smith, in his English Flora, observes that it generally composes the avenues about the residences of the French as well as English gentry of that date, and that Fenelon, in conformity to this taste, decorates with 'flowery lime trees' his enchanted isle of Calypso. The fragrance of the flowers are well known; they constitute an useful ingredient in *pot-pourri*. Bees are attracted, in great numbers, to collect honey from the flowers, in the season of flowering. The wood is smooth, delicately white, and uniform in its texture (vide p. 11, fig. *p.*); it is observed to be little subject to the attacks of insects. The beautiful carvings of Gibbon, before mentioned, which are dispersed about the kingdom, as in the choir of St. Paul's, Trinity College Library, at Cambridge, the Duke of Devonshire's, Chatsworth, &c. are stated to be of this wood *. It is also used by the turner in manufacturing light bowls, and boxes for the apothecary. The bark contains much mucilage; by maceration it separates into thin tough layers, which are manufactured into garden-mats, sometimes termed *bast mats*. These are well known to form a considerable part of the exports from Russia.

The broad-leaved lime, *tilia grandifolia*, attains to as large a size as the common linden; the young wood of the shoots is often red. The leaves have rather longer foot-stalks, the *ribs* and *veins* minutely hairy, or curiously fringed above the origin of each; all the under side of the leaves is finely downy, but not glaucous, as in the *tilia parvifolia* and American limes. This species, or, perhaps, variety, has been found in woods and hedges at Whitstable, Surrey; on the banks of the Mole, near Boxhill, by Mr. E. Forster; near Streatham Wells, Surrey, by Mr. Dubois; and in Stoken-church woods by Mr. Bicheno, but apparently planted *. This is stated to be the wild lime of Switzerland and the south of Europe, as the common species, *europæa*, is of the north. The *coral lime* is so nearly allied to this species, as to be considered by some botanists a variety only.

The small-leaved lime, *tilia parvifólia*, flowers about a month later than the last-mentioned tree. It is supposed to be the only true native species of lime. It is to be found frequent in Essex, Sussex, and Lincolnshire, and elsewhere, according to Ray. The leaves are much smaller than those of the above, being about two inches broad, dark green, and quite smooth above, glaucous underneath, with brown hairy tufts at the origin of each of their principal veins, as well as broad hairy blotches frequently found scattered over their surface. The comparative value of the timber of these last-mentioned species has not yet been determined. Among the American species of this tree the *smooth* or *bass-wood*, *tilia Americana*, is distinguished. Michaux informs us that he found it most abundant in Gennesse, which borders on Lake Erie and Ontario. In some districts between Batavia and New Amsterdam, it constitutes two-thirds, and sometimes the whole of the forests. It attains to the largest size in a loose deep fertile soil. It is found 80 feet in height, and 4 feet in diameter. The wood is white and tender, and is, in some places, substituted for that of the tulip-tree for the panels of carriage bodies, and the seats of Windsor chairs.

The white lime, *tilia alba*, is chiefly found on the banks of the Ohio, Susquehanna, and those of the streams which empty into them. The same authority observes, that it rarely exceeds 40 feet in height, and 12 or 18 inches in diameter.

The downy lime, *tilia pubescens*, is a native of the Floridas, and Southern parts of the United States. It resembles the American lime tree more than the preceding. The leaves are very downy on their under side, obliquely truncated at the base, and edged with fewer teeth than the other

* Evelyn's Sylva.

* Engl. Fl., vol. iii. p. 19.

species. The flowers are also more numerous, and produced in larger bunches. The wood has not been proved as to its properties. All these trees are ornamental, and afford a cool shade in summer.

Timber or Forest Species.

LIME-TREE.	TILIA.	Native of	Ft.
Red-twigged Lime-tree	*rúbra*	Britain	50
Yellow	*európæa*	Britain	50
Var. Jagged-lvd.	*laciniáta*	Britain	30
White	*álba*	Europe	30
Downy-leaved	*pubéscens*	Carolina	20
Smooth	*grandifólia*	Britain	—
Var. coral-twigged	*corallina*	Britain	—
Broad-leaved	*glábra*	N. Amer.	30
Silvery-leaved	*argéntea*	Hungary	—

Species for Ornament, &c.

Long-petaled	*petioláris*	——	—

ACERINEÆ.—*Nat. Sys.*

Polygamia Monœcia, Linn.

Eng. Name.	Bot. Name.
MAPLE-TREE.	ACER.

Calyx, five-cleft; *corolla*, five-petaled; *germs*, two or three superior; *style*, simple; *seed*, single, roundish shaped, its capsule terminated by a wing-like membrane.

Time of sowing—as soon as possible after the seeds are ripe: some are of opinion that the seed should be preserved in dry sand until February or the beginning of March. *Soil*—This genus will thrive in coarse land, but the European species attains the greatest size in a deep, moist soil, free of stagnant moisture; those which are natives of America require a drier soil than the above.

Uses—The wood of the common maple or sycamore is considered superior to that of the beech for the uses of the turner, in making domestic utensils, and also for the uses of the joiner for inlaying. It is sometimes also used by musical instrument-makers; but it is chiefly valued for its property of quick growth as coppice or underwood.

Timber or Forest Species.

Polygamia Monœcia, Linn.

MAPLE-TREE.	ACER.	Native of	Ft.
Common	*campéstre*	Britain	35
Italian	*ópalus*	Italy	50
Norway	*platanoides*	Europe	50
Sycamore (in Scotland, Plane-tree.)	*pseúdo-plátanus*	Britain	50
Sugar*	*saccharinum*	N. Amer.	40—70

Species for Ornament, Shelter, or Underwood

Striped-leaved, or variegated	*pséudo-plátanus variegátum,*	Britain	
Blunt-leaved	*obtúsum*	——	
Sir C. Wager's	*dasycárpum*	N. Amer.	
Bastard	*hýbridum*	Hybrid	
Cut-leaved	*platanoides laciniátum*	Europe	
Mountain	*montánum*	N. Amer.	8
Ash-leaved	*negúndo fraxinifólium*	——	30—40
Scarlet-leaved	*rúbrum*	——	
Tartarian	*tatáricum*	Tartary	

* In America this tree is called rock maple, hard maple as well as sugar maple. It is no where more abundant than between the 46th and 43d degrees of latitude, which comprise Canada. According to Dr. Rush, there are *ten millions of acres* in the northern parts of the states of New York and Pennsylvania, which contain these trees in the proportion of thirty to an acre. The wood is rejected in civil and naval architecture, but the wood of old trees is esteemed for inlaying mahogany, and is termed *bird's-eye maple*. To obtain the finest effect caused by the inflection of the medullary rays, which produce spots resembling the eye of birds, the log should be sawn in a direction as nearly as possible parallel to the concentric circles. The ashes are rich in alkaline principle; and it is asserted that four-fifths of the potash exported to Europe from Boston and New York, are furnished by the sugar maple. The sugar maple begins to be found wild in Canada, near the 48th degree of latitude, a little north of Lake St. John, and, as above stated, is most abundant between the 46th and 43rd degree. It is very rare in the lower parts of Virginia, the Carolinas, and Georgia. It flourishes best where the soil, though rich, is cold and humid, and situated on elevated declivities. But the great value of the sugar maple in America consists in the superior quantity of sugar afforded by the sap of the tree. In February or March, while the ground is covered with snow, and the cold is still intense, the tree is bored to the depth of half an inch within the wood, with an auger three-quarters of an inch in diameter, and in an obliquely ascending direction, on the south side of the tree, and at about eighteen or twenty inches from the ground. There are two holes made in this manner, four or five inches apart. Tubes of eight or ten inches long, and three-quarters of an inch in diameter, made of elder or sumac, having a portion of their length laid open, are inserted into them to conduct the sap into troughs, which are made to contain two or three gallons. The sap continues to flow or yield sugar, Michaux observes, for six weeks, after which it declines in quantity and quality. Four gallons of sap are considered to give one pound of sugar, and from two to four pounds is mentioned as the produce of a tree. Sheds are erected near the trees, where the persons who conduct the process of boiling the sap and extracting the sugar, are sheltered. Three persons are allowed to be sufficient to tend 250 trees, which give 1000 lbs. of sugar. It is stated that eighty millions of pounds of sugar are consumed in the United States, of which fifty millions are imported, ten millions furnished by the sugar cane of Louisiana, and ten millions from the maple. Of the other maples above enumerated, their comparative value, as timber trees, has not been sufficiently proved to allow of separate notices in the limits of these pages.

Montpelier ...... *monspessulánum* France
Oblong-leaved ... *oblóngum* ... Nepaul
Striped-barked ... *striátum* ... N. Amer.
Opalus-leaved .... *opalifolium*. S. Europe
Hungarian ...... *obtusátum* .. Hungary
Cretan .... *créticum* ... Levant
Evergreen .... *heterophýllum* ——
Bearded .... *barbátum* .. N. Amer.
Black Sugar ..... *nigrum* .... ——
Palmate .... *palmátum* .. China
Large-leaved .... *macrophýllum* . Columbia
Iberian .... *ibéricum* ..... Iberia
Round-leaved ... *circinnátum* .. Columbia

HIPPOCASTANEÆ. *Nat. Sys.*

Eng. Name. Bot. Name.
HORSE-CHESTNUT. ÆSCULUS.

Heptandria Monogynia. Linn.

Calyx, one-leaved, five-toothed, ventricose; *corolla*, five-petaled, irregularly-coloured, inserted into the *calyx*; *capsule*, three-celled; *seeds*, two, sub-globular, enclosed in a roundish-shaped capsule, containing three cells, and opening with three valves to emit the seeds.

The seeds should be preserved in dry sand till spring, and sown early in that season; but should the soil be dry, and free from the attacks of vermin, it is advantageous to sow as soon as the seeds are ripe. *Soil*—The horse-chestnut grows to the largest size in a sandy loam, but will grow in almost any kind of soil.

Uses—for fuel; but chiefly planted for the beauty of its flowers and its habit of growth. The common horse-chestnut, though a native of the northern parts of Asia, is never injured by cold in Britain, into which it was introduced about 1689, or, according to some, in 1683. It is sufficiently known for the beauty of its form when in full foliage and in flower, particularly when planted singly or in rounded groups, in lawns, and parks. For avenues it is less desirable, or where it overshadows roads, as the leaves fall early in the autumn. The species enumerated below, natives of North America, are all more or less ornamental, and deserving of a station in the margins of forest plantations. The comparative value of their timber has not yet been proved.

Timber or Forest Species.

HORSE-CHESTNUT. ÆSCULUS.
Common .... *hippocastánum* Asia 40

Species for Ornament, &c.

HORSE-CHESNUT. ÆSCULUS. Native of Ft.
Golden-striped ... *hippocastánum, fol. aur.*
Silver-striped ... ——, *fól. arg.*
Double-flowered .. *flóre pléno* .. ——
Flesh-coloured ... *cárnea* ..... ——
Ohio .... *ohioénsis* ... Nor.Amer.

Eng. Name. Bot. Name.
BUCKS-EYE-TREE. PAVIA.

Pale-flowered .... *pállida* .... N. Amer.
Smooth-leaved ... *glábra* ..... ——
Long-spiked ..... *macrostáchya* ——
Variegated-flowered *hýbrida* ... ——
Dwarf .... *discolor* .... ——
Neglected ...... *neglécta* .... ——
Red-flowered .... *rúbra* ...... ——10—8
Yellow-flowered .. *fláva* ...... —— 40

RHAMNEÁCEÆ. *Nat. Sys.*

CHRIST'S-THORN. ZIZYPHUS.

Pentandria Monogynia. Linn.

Calyx, tubular; the scales of the *corolla* are inserted in the calyx, and support the stamina. *Seed*, a two-celled nut, covered by a berry.

Time of sowing seeds—Autumn, in pots. *Soil*—Sandy loam. *Uses*—Chiefly planted for the singularity of its spines or thorns.

Species for Ornament, &c.

Common .... *paliúrus* .. S.Europe. Introduced in 1640.

HOLLY. ILEX.

Tetandria Tetragynia. Linn.

Calyx, four-toothed; *corolla*, wheel-shaped; *style*, wanting; *seeds*, four, solitary, horny, oblong, rounded on one side, cornered on the other, enclosed in a roundish four-celled berry.

Time of sowing—The berries should be placed under ground in a pot or large tub for one year, and then sown in the autumn upon a bed of sandy loam. *Soil*—The holly flourishes best in a dry, sandy soil, but will grow on land of almost any description. *Uses*—for the purposes of the turner, the inlayer, mill-wright, and engineer. The tree is in great esteem for the ornament of its evergreen foliage. Bird-lime is manufactured from its bark. The common holly, besides being a native of England, is also found wild in many parts of Europe, Japan, Cochinchina, North America, &c. As an evergreen fence it is superior to every other plant. It bears clipping

well, and is never injured by the severest frost. When reared to the height of two feet, by transplanting from the seed bed to a rich sandy soil, the plants may be removed, and planted as a hedge with perfect safety on well trenched and manured ground; this removes the only objection to the holly for fences, which is its slow growth. We have moved plants four feet in height successfully, and thus made a comparatively impenetrable live-fence the first season.

The *Carolina*, or *American Holly*, attains to a great height in its native soil. Its wood is held in great estimation, but in this respect it is not considered superior to that of our native species.

Species for Ornament, &c.

HOLLY.	ILEX.		
Common........	*aquifolium*..	Brit..	20—30
Var. Various-lvd...	*heterophýlla*	—	
,, Thick-leaved.	*crassifólia*..	—	
,, Hedgehog...	*ferox*......	—	
,, Striped do....	*echináta*...	—	
,, Yellow-berried.	*fláva*.....	—	
,, White-margined.......	*álba marginata*...	—	
,, Gold-edged..	*áurea margináta*		
,, Painted.....	*média picta*.	—	
,, Spineless....	*senéscens*...	—	
,, Milk-maid...	*lactária*....	—	
,, Carolina.....	*opáca*..	N. Amer.	30

JUGLÁNDEÆ. *Nat. Sys.*

Monœcia Polyandria. Linn.

Eng. Name.	Bot. Name.
WALNUT-TREE.	JUGLANS.

MALE FLOWER—ament or catkin, imbricated—*calyx*, scaly; *corolla*, six-parted; *filaments*, many, seven or more. FEMALE FLOWER—*calyx*, of four divisions, superior; *corolla*, with four divisions; *styles*, two; *seed*, a nut with four divisions, marked by intervening membranes, substance of the seed grooved—it is covered by a corticated, dry, oval-shaped, two-valved drupe.

Time of sowing—Preserve the nuts until February in their outer covering, after which they may be sown. *Soil*—A rich loamy soil is that in which the walnut attains the largest size, but it will succeed in very light, siliceous, sandy soils, as well as in clayey ones. *Uses*—The wood of the walnut is highly valued for many purposes, such as gun-stocks, domestic utensils, furniture, wainscoting, &c. Among the American Walnuts, the black, *Juglans nigra*, is considered to have wood of a more valuable quality than the common walnut, but this latter has a decided superiority in the excellence of its fruit and properties of its oil. The black walnut is considered to be one of the largest trees of America. On the banks of the Ohio, and on the islands of that river, Michaux states that he has found them from sixty to seventy feet in height and four feet in diameter, and that it is not rare to find them six or seven feet. Of the Hiccories, the Pignut, or Cárya *porcína*, is perhaps the most valuable, not for its fruit, but for its wood, being comparatively the best. The comparative value of these trees has not yet been proved in England—hitherto they have been looked upon as merely ornamental park trees, or subjects for botanical investigation. Some of them, however, rank among the largest trees in North America, where, according to Michaux, the general opinion there formed of the wood of the different species cut out from the natural forests is, that it is of great weight, strength, and tenacity, but liable to a speedy decay when exposed to damp, heat, and to worms

Forest or Timber Species.

Filaments of the female flower many.

WALNUT-TREE.	JUGLANS.	Native of	Ft.
Common........	*régia*......	Persia....	50
Var. Dble.-fruited.	*reg.máxima*.	—	—
,, Late-fruited..	*reg.serotina*.	—	30
Black..........	*nigra*......	N. Amer...	—
Shell-bark........	*cinérea*....	—	
Ash-leaved.....	*fraxinifólia*	—	
Winged-fruited..	*pterocárpa*.	Caucasus	
Hiccory-nut.....	*cárya*.......	—	
Filaments of the female flower		—	4 to 6
White hickery, or Shagback.....	*álba*.......	—	
Olive-fruited or.. Pecannut....	*olivæfórmis*.	—	60*
Flat-fruited.....	*compréssa*..	—	
Smooth-leaved...	*glábra*.....	—	
Narrow-leaved...	*angustifólia*.	—	
Bitter nut...	*amára*......	—	70 to 80
Pig nut.........	*porcína*....	—	

CONNARACEÆ. *Nat. Sys.*

Polygamia Monœcia. Linn.

Eng. Name.	Bot. Name.
TREE OF HEAVEN.	AILANTHUS.

MALE FLOWER—*calyx*, one-leafed, five-

* Michaux gives the character of the fruit as the finest flavoured of all the American walnuts, and to be more delicate than the European species. He advises it to be grafted on the common walnut,

parted, very small; *corolla*, five petals, acute, convolute at the base; *stamina*, filaments ten, compressed, the length of the corolla.

FEMALE FLOWER—*calyx*, as in the male; *corolla*, as in the male; pistil, germs 3—5; *styles* lateral; *capsules*, compressed; *seeds*, solitary; lens-shaped. Bisexual flowers as in the above.

		Native of	Ft.
Tall Ailanthus, or Tree of Heaven	*glandulósus*	China	50

Though a native of China, this tree bears our winters without injury. It grows fast, and attains to a great height; there are many trees of this kind in England from thirty to forty feet and more in height. It is a handsome tree, and the wood is said to be hard, heavy, and glossy, like satin, and susceptible of the finest polish. It is well worthy the attention of those who have it in their power to benefit themselves and the nation, by determining the comparative value of the different species of forest-trees. Some remarkable fine specimens of this and of comparatively rare American forest-trees, are in the grounds of the Duke of Northumberland at Syon.

Time of sowing the seeds—As soon as they are received from abroad in boxes of light earth, or sand and peat, protected under glasses.

LEGUMINOSÆ. *Nat. Sys.*

GLEDITSCHIA, or SWEET LOCUST.

BISEXUAL FLOWER—*calyx*, four-cleft; *corolla*, four-petaled; *stamina*, six; *pistil*, one. MALE FLOWER—*calyx*, three-petaled; *stamina*, six. FEMALE FLOWER—*calyx*, five-leaved; *corolla*, five-petaled; *pistil*, one.

Seeds, solitary, roundish, hard, shining, enclosed in a legume or pod, which is broad, much flatted, and divided by several transverse partitions.

Time of sowing the seed—Seeds procured from America, sow half an inch deep; they frequently remain two years in the ground before they vegetate. *Soil*—A sandy loam. *Uses*—This plant is valued for the beauty of its habit of growth. If planted in exposed situations, the branches are apt to be broken by the winds.

Polygamia Diœcia. Linn.

SWEET LOCUST.	GLEDITSCHIA.	Native of	Ft.
Three-thorned acacia	*triacánthus*	N.A.	40 to 60
Var. Spineless	*inérmis*	——	30 to 40
Single-seeded, or water acacia	*monospérma*	——	
Strong-spined acacia	*hórrida*	China	

(*Subordo, Papilionaceæ.*) *Nat. Sys.*

Eng. Name.	Bot. Name.
SOPHORA.	SOPHORA.

Decandria Monogamia. Linn.

Calyx, four-toothed; *corolla*, pea-flowered; *seed*, pod, long, slender, one-celled, numerous, forming prominent knobs on the surface of the pod.

Time of sowing seed—as soon as it can be procured; sow in pots filled with light earth. Plant in a sandy loam, and in a sheltered situation. *Use*—Valued for its handsome foliage and habit of growth.

SOPHORA.	SOPHORA.		
Japanese sophora	*japónica*	Japan	40

The wood of this tree, when fresh cut, emits an odour offensive to insects. In England we have seen it attain to upwards of 20 feet in height, with a proportionate diameter. Its pinnated leaves, which are smooth and of a beautiful green, give to the tree a graceful appearance. It is a native of Japan, and was introduced into England in 1753.

FURZE, WHIN, GOSE. ULEX.
Monadelphia Decandria.—Linn.

Calyx, of two ovate-oblong concave leaves, rather shorter than the keel; the upper with two small teeth, the lower with three; *corolla*, of five petals; standard, ovate-cloven; wings, oblong, rather shorter than the standard; keel, of two petals, straight, obtuse, cohering by their lower edges; filaments, in two sets, both united at the base; *anthers*, roundish, of two lobes; *germen*, oblong, nearly cylindrical, hairy; *legume*, or *seed-pod*, oblong, turgid, scarcely longer than the calyx of one cell, and two rigid elastic concave valves; *seeds*, from six to eight, polished, somewhat angular, slightly compressed, with a cloven tumid crest.

Species for Underwood, Fencing, &c.

FURZE.	ULEX.	Native of	Ft.
European, or Common	*europæ'us*	Britain.	
Dwarf	*nánus*	——	
Provence	*provinciális*	S. Europe.	

Time of sowing the seed—as soon as ripe in the autumn, or in March. *Soil.*—Dry, sandy, and gravelly soils suit best the growth of furze. It does not

however grow well on very thin heath soil, nor on damp clays. In Cornwall the common sort (*ulex europæus*) attains to 8 feet in height. In Devonshire, according to Vancouver, this species is termed French furze, although we suspect the *ulex provincialis* is the species which ought to come under this name. In some places the *ulex nana* is called French furze. The botanical distinctions are as follow:—

The Common Furze, *Ulex Europæus.*
Branches, erect, somewhat villous; *calyx*, pubescent, teeth obsolete converging, bracteas densely downy, oval, loose.

French Furze, *Ulex Provinciális.*
Branches, erect, somewhat smooth; *calyx*, a little pubescent, nearly as long as the corolla, teeth lanceolate, distant, bracteas minute, compressed.

Dwarf Whin, or Furze, *Ulex nâna.*
Branches, decumbent, hairy; teeth of the *calyx*, lanceolate, distant, and spreading; *bracteas*, minute, rounded, and close pressed.

From the above it is evident that the common furze and the French species are nearly allied; the dwarf furze has the leaves or spines shorter and closer, and the branches decumbent. These points of structure distinguish this species from the others at the first sight. Its value is estimated, in comparison to that of the common, as two to one inferior.

The common furze generally attains to its full size in four years, and it ought not to be cut more frequently. In local cases, as in the neighbourhood of potteries, Vancouver observes it makes a return of from 15*s.* to 20*s.* an acre annually. The wood is very hard, but never attains to a size available for the business of the carpenter. It is chiefly used for fuel, fences, and food for cows, horses, and sheep. On soils such as now alluded to, it makes a good fence, but requires peculiar management to prevent it becoming naked at the root. Sowing in three tiers on a bank is perhaps the best mode, as it allows of one to be kept low by the shears or bill, the second of higher growth, and the last to attain its natural stature. Respecting its merits as an article of fodder, a good deal has been written; as, for instance, by Duhamel in France, Evelyn in England, and Doctor Anderson in Scotland; and at this time, and for that purpose, as we are informed, it is cultivated successfully by Mr. Attwood of Birmingham. It requires to be chopped or bruised, as a preparative to its mastication. It would be valuable information to know the *comparative value* of the Whin to that of Lucern, Turnip, Red Clover, cultivated separately, or a combination of *Dáctylis glomeráta, Lólium perénne, Festúca duriúscula, Póa praténsis, Cynósurus cristátus, Lótus corniculátus, Phléum praténse, Trifólium répens, Trifolium minus, Medicágo lupulina*, and a small portion of *Achillea millefolium.* The produce of plants constituting the richest pasture plants, when combined on a furze soil, are proper to compare with the produce of furze, to ascertain the most profitable crop with which to occupy the soil in question, and this point has not yet been determined.

Eng. Name.	Bot. Name.
LABURNUM.	CYTISUS.

Calyx, labiate; *legume*, or *seed-pod*, tapering at the base; *seed*, kidney-shaped, compressed.

Time of sowing seed—March. *Soil*—This tree attains the greatest perfection on a sandy loam, but it may be planted in almost any kind of soil, except where stagnant moisture prevails. *Uses*—Although an ornamental tree, yet its wood or timber is valuable for various kinds of fancy wood-works, such as musical instruments, handles of knives, &c. The wood is very hard, takes a fine polish, and, when of sufficient size, may be manufactured into the most elegant kinds of furniture.

In the species here enumerated, the pods are one or two-jointed, joints globular.

Species for Timber as well as for Ornament, &c.

Monadelphia Decandria. Linn.
LABURNUM. CYTISUS.

Com. laburnum .. *labúrnum* .. Eur. , 10—25
Scotch laburnum . *alpínus*. . . .

ROBÍNIA, or LOCUST-TREE,
FALSE ACACIA, &c. ROBÍNIA *.

Calyx, one-leafed, four-cleft; *legume*, compressed, long, gibbous; *seed*, kidney-form.

Time of sowing the seed.—The end of March, on a bed of light earth. The

* So named by Linnæus in honour of J. Robin, a French botanist, who first introduced the tree into France from Canada, in the reign of Henry IV., about the year 1601.—Mich.

following spring transplant the seedlings in nursery rows about the end of March, the rows to be three feet apart, and the plants a foot and a half asunder in the rows. In one or at most two years they should be planted out where they are intended finally to remain. *Soil*—It will grow in almost any soil, but attains to most perfection in such as is light and sandy. *Uses*—The wood is hard and very durable. It is esteemed, in America, preferable to the best white oak for axle-trees of carriages, trenails for ships, posts for rail-fencing, and for withstanding the bad effects of moisture when fixed in damp ground. It is frequently substituted for box by the turners, for the manufacture of sugar-bowls, salt-cellars, candlesticks, forks, spoons, &c. It was cultivated in England in 1640, by Mr. John Tradescant, or nearly two hundred years ago. But the only satisfactory authenticated statements we can find of the greatest age of Locust trees now growing in England (with that of their produce of timber) does not exceed sixty years. A locust-tree, in the grounds of the late Charles Bloomfield, Esq., Bury St. Edmond's, of sixty years growth, in 1829, measured in height from forty to fifty feet, and the circumference at three feet from the ground six feet seven inches, the solid contents being fifty-four feet of timber*. The limits of these pages do not permit further details, except to observe that, owing to the brittle nature of the wood when young, the leading shoots of the stems, as well as the branches, are very liable to be broken by the wind, and probably it is from injuries of this kind that many trees are found unsound even before forty years of growth: great attention to early training or pruning appears to be required by the locust. The comparative strength as to fracture of its timber compared to that of oak, appears to be in favour of the former, according to Professor Barlow, fine English oak 1672 to locust 1867. The comparative value of the timber of the other different species of Robinia mentioned below, has not yet been ascertained: their value for ornament is well known.

* Withers MS. Correspondence.

Diadelphia Decandria. Linn.

ROBINIA.	ROBINIA.	Native of	Ft.
Locust-tree, or False Acacia	*pseudo acácia*	N. Am.	35-50
Clammy	*viscósa*	——	30-40
Spineless	*inérmis*	——	—
Long-leaved	*macrophýlla*	Siberia	—
Parasol	*umbraculifera*	——	—
Upright	*stricta*	——	—
Pendulous	*péndula*	——	—

Ornamental only.

Rose Acacia	*hispida*	Carolina	60
Purple	*purpúrea*	——	—
Smooth-branched	*rosea*	Carolina	—

Eng Name. Bot. Name.

KENTUCKY COFFEE-TREE, OR HARDY BONDUC. GYMNOCLADUS.

Diœcia Decandria. Linn.

MALE FLOWER—*Calyx*, five-toothed; *corolla*, five petalled. FEMALE FLOWER—the same as the male; *stile*, one; *legumen*, one-celled; *seeds*, several, embedded in a pulp. Propagated by suckers from the root, as well as from seed.

Kentucky Coffee-tree *Canadensis* N. Amer. 40

There is only one species of this tree. In its native soil of that part of Genesee which borders on lake Ontario and lake Erie, and in the states of Kentucky and Tennessee, Michaux states it to attain to fifty or sixty feet in height, and that the stem is often destitute of branches for thirty feet, while the diameter seldom exceeds twelve or fifteen inches. In summer, when it is fully grown, it has a fine appearance. On young trees the leaves, which are doubly compound, are three feet long and twenty inches wide. The bark is very rough, and detaches itself in small vertical strips. The name of coffee was given to this tree by the early emigrants to Kentucky. The seeds appear to possess no culinary value. The wood is very compact and of a rosy hue, which fits it for the use of the cabinet-maker. Michaux observes that, like the locust, it exhibits almost nothing but heart-wood, for that six inches in diameter has only six lines of sap-wood. These qualities, he observes, recommend it for culture in the forests of the north and centre of Europe. It was introduced into England, in 1748, by Archibald Duke of Argyle, but its culture appears not to have extended beyond the garden.

AMYGDALINÆ. *Nat. Sys.*

Eng. Name.	Bot. Name.
ALMOND-TREE.	AMYGDALUS.

Icosandria Monogynia. Linn.

Calyx, five-cleft, inferior; *petals*, five; *seed*, a nut, oval-shaped, compressed, acute, with prominent sutures on each side, netted in four rows and dotted, enclosed in a villose or woolly drupe.

Time of sowing seed—Autumn; cover with light dry earth, three inches deep. *Soil*—A sandy loam, in a sheltered situation. *Uses*—Gay and ornamental flowers in the spring: the naked seed of the almond, properly so called, yields an essential oil, and, by trituration, forms an emulsion, or cooling beverage, much used.

The naked seed or almond of the *Amygdalus amara* affords an oil of similar properties to that of the *Amygdalus communis*, but the bitter principle contained in the farinaceous part of the seed is deleterious, containing prussic acid.

Species for Ornament, &c.

ALMOND-TREE.	AMYGDALUS.	Native of	Ft.
Sweet almond	*commúnis*	Barbary	18
Bitter almond	*amára*	——	—
Double blossomed	*flore pléno* (*Pérsica*)	Persia	—
Chinese	*cochinchinénsis*	China	

POMACEÆ. *Nat. Sys.*

MESPILUS.	MESPILUS.

Icosandria Di-pentagynia. Linn.

Calyx, five-cleft; *petals*, five; *berry*, inferior; *seeds*, five, bone-like, enclosed in a globular berry.

Time of sowing the seed—autumn, or as soon as ripe. *Soil*—a rich loam; but it will succeed in any description of soil free from the extremes of moisture and dryness. *Uses*—for its ornamental habit of growth and its fruit.

Species for Ornament, &c.

MESPILUS.	MESPILUS.		
Medlar, common	*Germánica*	England	12
Var. Uprt. medlar	*stricta*	——	—
„ Dutch	*diffúsa*	——	—
Quince-leaved mespilus	*tomentósa*		
Tansy-leaved hawthorn	*tanacetifolia*	Greece	12
Large-flowered mespilus	*grandiflóra*	S. Europe	—

Eng. Name	Bot. Name.
PEAR-TREE.	PYRUS.

Calyx, five-cleft; *petals*, five; *seeds*, several, oblong, blunt, accuminate at the base, convex on one side, flat on the other, enclosed in a pome or apple, fleshy, with five membranous cells.

Time of sowing the seed—Spring: preserve the seed during winter in dry sand. *Soil*—rich clayey loam, but also on gravelly and chalky soils on elevated, exposed situations. *Uses*—for underwood, ornamental blossoms and fruit: the white beam (pyrus aria), however, is considered by some to rank as a timber-tree; the wood, tough and hard, is sometimes used for axletrees, handles of tools, &c. The wood of the wild service-tree (torminalis) is likewise applied to the same purposes, and its fruit is frequently brought to market.

Species for Ornament, &c.

PEAR-TREE.	PYRUS.	Native of	Ft.
Arbutus-leaved	*arbutifol.*	Virginia	
Var. Red-fruited arbutus-leaved	*rúbra*	——	
„ White-fruited arbutus-leaved	*álba*	——	
„ Black-fruited arbutus-leaved	*nigra*	——	
Snowy	*nivális*	Austria.	
Wild pear-tree	*commúnis*	England	
Woolly-leaved	*pollvéria*	Germany	
Crab-tree	*málus*	Britain	
Chinese apple	*spectábilis*	China	
Siberian crab	*prunifólia*	Siberia	
Small-fruited crab	*baccáta*	——	
Sweet-scented crab	*coronária*	Virginia	
Narrow-lvd. crab	*angustifolia*	N. Amer.	
Com. quince-tree	*cydonia*	Austria	
Willow-lvd. crab	*salicifólia*	Levant	
White beam-tree	*ária*	Britain	30
Swedish do.	*intermédia*	Sweden	
Wild service pear-tree	*torminális*	Eng.	30—40

AMELANCHIER.	AMELANCHIER.

Icosandria Pentagynia. Linn.

Snowy Amelanchier. *botryápium*. N. Amer.

CRATÆGUS.

Calyx, five-cleft; *berry*, inferior; *seeds*, two, roundish, umbilicated, body somewhat long, distinct, cartilaginous.

Time of sowing seed—Autumn. *Soil*—will succeed in almost any kind of soil of intermediate quality as to moisture and dryness: the most ornamental and useful of the species are the vari-

eties of the common hawthorn (oxyacantha), the Glastonbury is remarkable for the season of the year in which it comes into flower, which is usually in January or February, and sometimes at Christmas, according to the state of the weather then, and of that during the previous summer and autumn. The wood of the common Hawthorn is hard and tough, and is esteemed for axle-trees, handles of tools, &c. When planted singly it not unfrequently rises to 20 or even 30 feet in height; and we have measured stems of individual trees of this species, varying from 3 to 7 feet in circumference. The merits of this and the interesting species and varieties mentioned below, for ornament in park scenery, come more properly for discussion under the second division of the subject of Planting, proposed in the introduction to this treatise: but though their value, in an economical point of view, has not yet been determined, their natural habits and growth offer matter well worthy the attention and investigation of the forest-planter, and they are therefore here enumerated. *Uses*—The common hawthorn, it is well known, is used for making quick or live fences. It is of great importance to have the plant strong and large before finally planting it in the hedge-row. This plant delights in a deep soil, and where it is not naturally such, its depth ought to be increased. When the plants or quicks are large, they produce a fence in a short space of time, and save much expense in weeding, nursing, and temporary fencing.

Species for Ornament, &c.

CRATÆGUS.		Native of	Ft.
Great American hawthorn	*cratægus coccínea*	N. Amer.	
Maple-leaved	— *cordáta* ..	——	
Pear-leaved	— *pyrifólia*	——	
Oval-leaved	— *elliptica* .	——	
Hollow-leaved ...	— *glandulósa*	——	
Yellow-berried ...	— *fláva* ...	——	
Gooseberry-leaved	— *parvifólia*	——	
Great red-fruited ..	— *punctáta*.	——	
Var. Yellow-fruited	— *áurea* ...	——	
Common cockspur	— *crusgálli*	——	
Var. Pyracantha-leaved	— *pyracanthifólia* .	——	
„ Willow-leaved	— *salicifólia*	——	
White-thorn	— *oxyacántha*	Britain	
Var. Common	— *vulgáris*.	——	
Var. Great-fruited.	— *májor* ...	——	
„ Glastonbury .	— *præcox* ..	——	
„ Dbl.-flowered.	— *pléna* ...	——	
Yellow-berried .	— *áurea* ...	——	
Parsley-leaved .	— *azarólus* .	S. Europe	
Elegant red	— *élegans*	——	
Sweet-scented ...	— *odoratissima*.	Crimea	
Woolly-fruited ...	— *eriocárpa* ..	Britain	
Sloe-leaved	— *prunéllifólia*.	N. Amer.	
Cut-leaved	— *dissécta*	Persia	
Comb-shaped	— *pectináta* ..	——	
Frosted	— *pruinósa* ...	——	
Crimson	— *punicea*	Dahuria	
Black-berried	— *melanocárpa*.	Tauria	

OLEINÆ. *Nat. Sys.*

Eng. Name.	Bot. Name.
ASH-TREE.	FRAXINUS.

Polygamia Diœcia. Linn.

BISEXUAL. MALE FLOWER—*calyx*, none, or a four-parted perianth; *corolla*, none, or four petals; *stamina*, two; *pistil*, one; *capsule*, one-seeded, terminated by a spear-shaped membranous wing. FEMALE FLOWER—*calyx*, none, or a four-parted perianth; *corolla*, none, or four petals; *pistil*, one; *capsule* and *seed*, the same as in the bisexual flower.

Time of sowing the seed—Autumn, as soon as ripe, or dry the seed in a cool airy loft, and preserve them in sand during the winter; and then in April sow them on beds of fresh mellow soil; the plants will appear in the following spring; but if sown in the autumn as soon as ripe, most of the plants will appear in the same season.

Soil—Clayey loam brings the ash to the greatest perfection, but it will grow on every description of soil. Evelyn mentions an ash-tree of 132 feet in height, and Young, in his Irish Tour, states the length of an ash, at thirty-five years growth, to be 70 feet.

Uses—This wood is hard and tough, and much esteemed for implements of husbandry, and also for the purposes of the coach-maker, cooper, turner, &c. It makes a profitable kind of underwood, and may be cut every eight years for hoops, and every fourteen years for hop-poles, &c. It is said that the leaves, when eaten by cows, give the butter which is made of their milk a rank taste; butter, however, in the spring, and towards autumn, has frequently a rank taste, when the cows yielding it are completely out of the reach of leaves of any kind of forest-trees whatsoever.

When planted in hedge-rows, the ash is apt to impoverish the soil around it in a greater degree than most other trees. This tree is by many considered to stand next in value to the oak. It is mentioned as such by the oldest writers*. Where pollard trees are permitted, the ash makes one of the most profitable. Dr. Withering states, that a decoction of two drachms of the bark has been used to cure agues. The Manna Ash, *Fráxinus rotundifólia*, in England seldom attains to more than 20 feet in height; the leaflets are shorter, of a deeper green colour, and more deeply serrated on the margins than those of the common ash. It is a native of Italy, and is most abundant in Calabria, where it grows spontaneously on the lower parts of the mountains. This tree affords the well known medicinal laxative substance termed *manna*. It is obtained by making a horizontal incision in the stem of the tree towards the end of July. The fluid gum is received into cups formed of the leaves of the maple, and conducted into them by the foot-stalks of the leaf, or by straws inserted into the incisions. The manna continues to exude from the wounds of the bole for about a month after the incision is first made†. The comparative merits and value of the other foreign species of ash mentioned below, remain yet to be proved by the British forester; and we shall here, therefore, only observe, that the white ash of North America, among those enumerated below, is the only species that at present is considered to approximate to, and rival the common ash in value. In New Brunswick and Canada it most abounds, and is most multiplied in the United States, north of the river Hudson. Its most favourable sites are the banks of rivers and the edges and surrounding acclivities of swamps; it there sometimes attains to eighty feet in height.

* Vide Gentleman's Magazine, 1785; Hunter's Evelyn; Withering's Arrangement of British Plants; Pennant's Tour, 1772, p. 29; Gilpin's Forest Scenery, Vol. II., p. 280; Martyn's Ed. Miller's Gard. Dict.; Art. Fraxinus.

† See Trans. Royal Soc., vol. lx.

Timber or Forest Species.

ASH-TREE.	FRAXINUS.	Native of	Ft.
Common........	*excélsior*...	Britain...	70
Entire-leaved....	*simplicifólia*	——	30
White American.	*americána*..	N.Amer...	40
Var. Black do....	*pubéscens*...	——	—
„ Red do.....	*rúbra*.....	——	—

Species for Ornament, &c.

Weeping........	*excel.péndula*	Britain...	70
Horizontal......	„ *horizontális*	——	
Erose-leaved.....	„ *erósa*..	——	
Striped bark.....	„ *striáta*.	——	30
Walnut-leaved...	*juglandifólia*		
Aleppo.........	*lentiscifólia*.	Aleppo	
Flowering.......	*órnus*.....	Italy	
Many-flowered...	*floribúnda*.	Nepaul	
Manna.........	*rotundifólia*	Italy	
Cloth-leaved.....	*pannósa*...	N.Amer.	
Four-sided......	*quadranguláta*	——	
Flat-seeded......	*platacárpa*..	——	
Long-leaved.....	*longifólia*..	——	
Red-veined......	*rubicúnda*..	——	
Green-branched..	*viridis*.....	——	
Cinereous.......	*cinérea*....	——	
Grey-branched...	*álba*.......	——	
Richards'.......	*Richárdi*..	——	
Sharp-leaved.....	*oxycárpa*		
Elder-leaved.....	*sambucifólia*	N.Amer.	
Silver-leaved.....	*argéntea*...	Corsica	
Elliptic-leaved...	*elliptica*...	N. Amer.	
Oval-leaved.....	*ováta*.....	——	
Mexican........	*mexicána*...	Mexico	
Dotted-stalked...	*epiptera*....	N. Amer.	
Red-veined......	*rubicúnda*...	——	
Powdered.......	*pulverulénta*.	——	
Mixed.........	*mixta*.......	——	
Expanded......	*expánsa*.....	——	

ELÆAGNEÆ. *Nat. Sys.*

Eng. Name.	Bot. Name.
OLEASTER-TREE.	ELÆAGNUS.

Tetrandria Monogynia. Linn.

Calyx, four-cleft, bell-shaped; *corolla*, none; *drupe*, inferior; *seed*, a nut, oblong, obtuse.

Time of sowing seed—Autumn: may be sown in pots or propagated by layers. *Soil*—A sandy loam is what it affects most. *Uses*—It is admired for the fragrance of its foliage. The comparative value of its wood has not yet been proved.

Species for Ornament, &c.

OLEASTER-TREE.	ELÆAGNUS.	Native of	Ft.
Narrow-leaved...	*angustifólia*.	S. Europe.	18

URTICEÆ. *Nat. Sys.*

Eng. Name.	Bot. Name.
MULBERRY-TREE.	MORUS.

Monœcia Tetrandria. Linn.

MALE FLOWER—*calyx*, four divisions; *corolla*, none. FEMALE FLOWER—*calyx*, four-leaved; *corolla*, none; *style*, two; *seed*, single, ovate, acute, covered by the calyx, which ripens into a large fleshy berry.

Time of sowing seed—March, in light earth, with gentle artificial heat; or propagate by layers. *Soil*—It flourishes best on a rich sandy loam; but it will thrive even on very sandy soils, if of proper depth. *Uses*—The black mulberry is chiefly cultivated for its fruit, and the white mulberry for its leaves, which are considered the best food for the silk-worm. It has been long ago recommended that, instead of pulling the leaves off singly for the food of the silk-worm, they should be shorn off, together with their young branches, by which the tree is much less injured.

Timber or Forest Species.

MULBERRY-TREE.	MORUS.		
Common	*nígra*	Italy	30
Red	*rúbra*	N. Amer.	—
Species for Ornament, &c.			
White	*álba*	China	20
Paper	*papyrífera*	Japan	

LOTE OR NETTLE-TREE.	CELTIS.

Polygamia Monœcia. Linn.

BISEXUAL FLOWER—*calyx*, five-parted; *corolla*, none; *stamina*, five; *styles*, two; *drupe*, one-seeded.

MALE FLOWER—*calyx*, six-parted; *corolla*, none; *stamina*, six; *seed*, a nut, roundish.

LOTE or NETTLE-TREE.	CELTIS.			
European Nettle-tree	*austrális*	S. Eu.	20 to 40	
Eastern	*orientális*	Levant	—	—
American	*occidentális*	N Am.	—	50
Willdenow's	*Willdenowiána*	China	—	—
Chinese	*sinénsis*	——	—	—
Tournefort's	*Tournefórtia*	Levant	—	—

Time of sowing the seed—March, or, if it can be procured in time, sow in the autumn, in a mixture of peat and loam, placed in pots or boxes, sheltered from the frost, and shaded in hot weather from the sun. These trees require protection for the first two years, or while young; afterwards they may be planted in any moderately exposed situation. The soil best adapted to them is a sandy loam. *Uses*.—the wood of the European nettle-tree is considered to be one of the hardest; and Evelyn says, that in former times it was used for the manufacture of musical instruments. The American nettle-tree is similar in its foliage and general appearance to the European species; the branches of both are numerous and slender, and the limbs take their rise at a small distance from the ground, and grow in a horizontal or an inclined direction. Michaux observes, that the comparative value of the wood has not been proved in America, but that it is similar in properties to the former species. As yet those other species enumerated above are considered as merely ornamental.

Eng. Name.	Bot. Name.
ELM-TREE.	ULMUS.

Pentandria Digynia. Linn.

CALYX—five-cleft, inferior, permanent; *corolla*, none; *seed-vessel*, compressed, flat, one-seeded; *seed*, roundish, slightly compressed.

Time of sowing the seed—As soon as ripe in May, on a bed of fresh loamy earth to be shaded from the mid-day sun, until the plants appear to be well rooted. The Wych elm is almost the only species raised from seed; the other species are raised by layers. The American elms produce seed, but it seldom retains its vegetative powers long enough to be brought to England. A deep loam grows the elm to the greatest perfection. *Uses*—The wood is hard and tough, and resists the effects of moisture better than most other kinds of wood. Its tenacious adhesive quality renders it valuable for many important purposes, keels of ships, naves of wheels, &c.

ELM-TREE.	ULMUS.	Native of		Ft.
English	*campéstris*	Britain	80	100
Cork-barked	*suberosa*	——	—	—
Dutch cork-barked	*májor*	——	—	—
Wych	*montána*	——	—	—
Smooth	*glábra*	——	—	—
Pendulous, or weeping	*pendulína*	——	—	—
American	*Americána*	N. Am.	—	—
White Hungarian	*álba*	Hung.	—	—
Curled	*críspa*	N. Am.	—	—
Dwarf	*púmila*	Siberia	—	—
Slippery	*fúlva*	——	—	—
Chichester	*vegéta*	N. Am.	—	—
Winged	*aláta*	——	—	—

There are new varieties of the elm of recent introduction, as the Huntingdon, Chichester, fan-leaved, &c. These exhibit a more rapid and luxuriant growth than the other species mentioned; but their comparative value, as regards the quality of the timber, has not yet, as far as we know, been satisfactorily determined. There is a difference of opinion as respects the comparative value of the wych and the English elms. The weight of opinion is in favour of the English elm, *ulmus campestris*. The corked barked elm is held on all hands to be very inferior, particularly the Dutch species. Where hedge-row timber is at all admissible, the elm is perhaps of all other trees the most to be preferred. The practice of lopping and *pollarding* these trees sadly disfigures the general appearance of the country where it is practised to any extent, and the timber of such pollards is almost always found defective. The wych elm attains to a great size; Marshall (on Planting, vol. ii.) mentions a tree of this kind near Bradley church, in Suffolk, which, in 1754, measured twenty-five feet five inches in circumference, and in thirteen years after measured twenty-six feet three inches, at five feet from the ground.

AMENTACEÆ. *Nat. Sys.*

Eng. Name.	Bot. Name.
WILLOW-TREE.	SALIX.

Diœcia 1, 2, 3, 5, *Andria*. *Linn.*

Calyx, aments composed of scales; *corolla*, none. In the MALE FLOWER, the nectary consists of a melliferous gland; in the FEMALE FLOWER, the style is bifid. *Seed—vessel* or capsule one-celled, two-valved, downy, numerous, ovate, very small.

Time of sowing seed—March; but generally propagated by cuttings or sets in the spring. *Soil*—Moist soils of almost every description will suit this tree. *Uses*—The osier (*salix viminalis*) affords the materials of the basket-maker; also binders, thatching-rods, rakes, scythe-handles, &c. The other species enumerated, but especially the *Salix Russelliana*, which is perhaps of more rapid growth than the rest, affords poles and rails, and is made use of for a great variety of other purposes.

The bark of the *sálix álba*, Doctor A. T. Thompson observes, supplies the place of the Peruvian bark, in the case of intermittent fevers. It owes its efficacy to a peculiar alkaline principle which has been termed *salicina*, and which can be separated from the other components of the bark.

Timber or Forest Species.

Species, with subserrate villose leaves.

WILLOW-TREES.	SALIX.	Native of	Ft.
Common white...	*álba*.......	Britain ...	40
Ash-coloured	*cinérea*	——	20
Osier (bushy)....	*viminális* ..	——	
Round-leaved....	*cáprea*.....	——	30

Species with leaves smooth, serrate.

Long-leaved triandrous	*triándria*...	Britain...	30
Peach-leaved.....	*amygdalína*.	——	—
Duke of Bedford's	*Russelliána* .	——	—
Sweet, or bay-lvd.	*pentándria* .	——	
Crack..........	*frágilis*	——	15
Halbert-leaved ...	*hastáta*	——	—
Rose	*hélix*	——	—
Golden	*vitellina*....	——	—
Weeping........	*babylónica*..	——	40

Eng. Name.	Bot. Name.
POPLAR.	POPULUS.

Diœcia Octandria. Linn.

Calyx of the ament, a flat scale, torn at the edge; *corolla*, turbinated, oblique, entire; *stigma* of the FEMALE FLOWER, four-cleft; *seeds*, many, ovate, furnished with capillary pappus, which act as wings to carry the seeds by the wind, enclosed in a one-celled capsule.

Time of sowing seed—Propagated by cuttings, suckers, and layers; the first mode preferred. *Soil*—It affects a moist soil, but will grow in almost every description of soil. *Uses*—The chief use of the wood of the forest species is for the turner in the manufacture of trays, bellows, and various domestic utensils. The wood of the Abele poplar is found to be very useful for water-works, having been proved to keep sound for a long series of years when so used*.

The common grey poplar is sometimes confounded with the abele or white species. The leaves of the former are smaller and rounder shaped, and but little cottony underneath, sometimes smooth. The bark of the stem becomes of a beautiful silvery grey hue. This species is of slower growth, but,

* Notwithstanding the general disrepute of the wood of the Lombardy poplar for out-door works, there are instances of its durability being proved, in making close palings, when well saturated with coal-gas tar.

in time, becomes a handsome tree, with the branches of the top more compact than in that of the abele. The leaves of the abele are densely cottony underneath, as are also the young shoots and footstalks of the leaves. The root is powerfully creeping, which unfits the tree to be planted in fields where pasturage or tillage exists. The creeping roots send up suckers, used in propagating the tree. Layers are also used, as well as cuttings of the branches, for the same purpose. It having been doubted whether this or the former was the true abele of the Dutch, where in Holland the abele is highly valued, we procured specimens from a celebrated grower in that country, and these proved, beyond a doubt, that the abele of Holland is the *Populus alba*, or abele of Britain, and not the *Populus canescens*, or grey poplar. The value of this tree, in peaty and low damp soils, is well worthy the attention of the forest-tree planter. Besides the uses of the wood before remarked, it is considered good for wainscoting, floors, laths, and packing cases, indeed, from the boards of it not splitting by, but closing on, the heads of nails, it is considered superior to deal for the latter purpose. The wood of the Lombardy poplar is held in esteem for the like purpose. The bark of the abele is recommended in the cure of intermittent fevers. It should be gathered in summer, when full of sap, and dried by a gentle heat. When powdered, a dram of it is given every four hours between the fits. A white poplar in St. John's College Walks, Cambridge, blown down in a hurricane, Nov. 6, 1795, was forty-two feet in length, and nine feet ten inches in circumference, which, with the limbs, gave 328 cubic feet of timber.

The black Italian poplar attains to a large size in a comparatively short space of time, as is proved at page 89. It delights in moist situations, but grows fast in almost every kind of soil. It is a more valuable tree than the Lombardy poplar, and for upland soils superior to the abele. The timber is used for the like purposes as those of the former. The property of slow combustion seems general in the wood of all the different species of poplar, and this property, which renders the wood valuable for floors and internal works in buildings in case of accidents by fire, renders it of inferior value for fuel.

The aspen, aspe, or trembling poplar, attains to a large size and succeeds well in almost every description of soil, except clay. The roots are very impoverishing to the land, and the aspen is, therefore, confined to local sites. The well-known property of being moved by the slightest current of air possessed by the leaves of this tree, appears to originate in the structure of the petiole, or footstalk of the leaf, the planes of which (being a compressed petiole) are at right angles to those of the body of the leaf, which is itself furnished with two glands, running one into the other. Such are the opinions of Linnæus and of Dr. Stoke regarding this point. But the flattened footstalk is common to all the poplars with which we are acquainted, and all are more or less subject to have the leaves easily put in motion; in fact the structure of the petiole, as now described, will readily explain the matter to the observer, and that in proportion to the length and slender structure of a petiole so constituted to that of the body of the leaf, depends its sensibility of any cause of motion. Lightfoot mentions, that this almost constant trembling of the leaves of the aspen had given rise to a superstitious opinion in some parts of the Highlands of Scotland, that our Saviour's cross was made of the wood of this tree, and that therefore its leaves could never rest.

Among the North American species of poplar, the Canadian (*monilifera*) offers great merits, as far as experience in its culture in Britain affords the means of drawing satisfactory conclusions. It affects a moist, deep, rich soil; such are fertile peat and alluvial soils. Mr. Hursthouse of Tydd, near Wisbeach, planted trees of the *Populus monilifera*; in 1822, and nine years after he had trees of a size to saw into scantlings, which, for toughness of texture, his carpenter stated to exceed any he had before met with. This species is more nearly allied to the *Pópulus anguláta*, or Canada poplar, than to any other species. The Canada poplar is distinguished at first sight by its angular branches. These arise from the lower side of the

base of each footstalk, one from the centre of the base, and one from each side of it. The leaves being arranged alternately on the shoot, and these angles or wings falling or proceeding from the base of each, and terminating at or just before they reach the next bud, or leaf, form five angles of the shoot. When a shoot is divided, the pith exhibits five angles, corresponding to these nerves of the leaf-stalk. A similar arrangement takes place on the shoots of the Canadian poplar, with this exception, that the angles are seven in number instead of five; they are also much less prominent. The botanical characters are specifically distinct; but as these are not often within the reach of the inquirer, the above may be found useful in distinguishing these two species, often confounded together. The magnificent broad shining leaves of the Carolina poplar, with the peculiar habit alluded to, its rapid growth, and general appearance, when advanced to the size of a timber tree, render it well worthy a place in sheltered glades of plantations. The lower part of Virginia, Michaux informs us, is the most northern point at which this species is found in America, it being more common in the two Carolinas, in Georgia and Lower Louisiana, on the marshy banks of the great rivers, where it attains to eighty feet in height, with a proportional diameter. He terms the Canadian poplar *Pópulus Canadénsis*; and he gives our *monilifera* to another species, having a smooth cylindrical stem, but similar to the *Pópulus lævigáta*. He calls our Canadian poplar cotton-wood, and states that it rises to seventy or eighty feet in height, and three or four feet in diameter; and it is preferred as a useful tree. The Ontario, or smooth-leaved poplar, may rank next in order to those just now mentioned, for rapidity of growth and beauty of its foliage. The comparative value of its timber remains to be determined by time. Those other species enumerated below are all deserving of a place in plantations to prove the comparative value of each.

Timber or Forest Species.

POPLAR.	POPULUS.	Native of	Ft.
Com. grey, suc.	..*canéscens*...	Britain ...	40
Black, suc. cut...	*nigra*	——	30
Lombardy, cut.	..*dilatáta*....	Italy	70
Balsam „	..*balsamifera*.	N.Amer...	40
Athenian „	..*Græca*	Greece ...	—
Canadian „	..*monilifera*..	N.Amer...	30
Aspen „	..*trémula*....	Britain ...	50
Abele-tree, suc.	..*álba*.......	——	40

Ornamental Species.

Carolina, lay.	*anguláta* ...	N.Amer...	40
Heart-leaved „	*cándicans* ..	——	20
Various-leaved „	*heterophýlla*	——	—
Smooth-leaved „	*lævigáta* ...	——	30
Weeping „	*péndula*	——	—
Trembling „	*trépida*	——	—
Large-dented „	*grandidentata*	——	—
Laurel-leaved „	*laurifólia*....	Altay.	—
Slender-twigged „	*viminea*....	N.Amer.	—

(*Subordo, Betulinæ.*) *Nat. Sys.*

Eng. Name.	Bot. Name.
ALDER-TREE.	ALNUS.

Monœcia Tetrandria. Linn.

MALE FLOWER—*receptacle* of the ament, wedge-shaped, truncated, composed of three flowers; *calyx*, scaly; *corolla*, four-parted; *stamina*, four. FEMALE FLOWER—Ament *calyx*, scaly, or two-flowered; *corolla*, none; *seed*, compressed, oval, naked.

Time of sowing seed—Autumn or spring: if left until spring, preserve them in dry sand. *Soil*—Moist or damp soils are the most fit for the growth of the alder. *Uses*—This tree is the most valuable of the sub-aquatic forest-trees. The wood (see p. 9, fig. 1.) is esteemed for under-water-work, as piles, pipes, pumps, sluices, &c. The charcoal made of its wood is highly valued for the manufacture of gunpowder. The bark and young shoots afford a yellow dye, and also afford a basis for black colours.

Besides the uses just mentioned of the wood of the common alder, the roots and knots furnish a valuable material for cabinets, this part of the wood being often beautifully veined. The bark is used by dyers, tanners, and leather dressers, and for tanning nets. An ounce of the bark powdered and boiled in three-fourths of a pint of water, with an equal quantity of logwood and solution of copper, tin, and bismuth, six grains each, and two drops of solution of sulphate of iron, will dye a strong deep *boue de Paris*. The Laplanders are said to chew the bark, and dye their leathern garments with their saliva. The shoots cut in March are said to dye a fine cinnamon colour and a handsome drab or tawney when previously dried and

powdered. The value of the charcoal in the manufacture of gunpowder is well known.

Linnæus says that horses, cows, sheep, and goats eat it, but that swine refuse it. The tongues of horses feeding upon it are said to turn black during its use. It is very astringent, and most probably unwholesome to animals as food. In low damp situations, by the sides of streams, &c., it makes the best hedges, as it grows in such situations freely, where the thorn or quick will make little or no progress. In damp situations it is an useful coppice wood. The economical properties of the varieties of the common alder enumerated below have not hitherto been proved; they are ornamental, and deserving of a position in the damp margins of woods.

The American species are considered to be inferior to the common alder as regards the uses of the wood and the bark; nor as yet are there any proofs of the comparative value of the Siberian and European species, beyond that of giving variety to the effects of foliage in plantations.

Timber or Forest Species, and for Ornament, &c.

ALDER-TREE	ALNUS	Native of	Ft.
Common	*glutinósa*	Britain	25
Var. Silver-striped	*foliis argénteis*	——	—
„ Emarginate	*emargináta*	——	—
„ Cut-leaved	*incisa*	——	—
„ Jagged-lvd.	*laciniáta*	——	—
„ Oak-leaved	*quercifólia*	——	—
„ Oblong-lvd.	*oblongáta*	S. Europe	—
„ Elliptic-lvd.	*elliptica*	——	—
Hoary-leaved	*incana*	Europe	—
Var. Angular-leaved		——	—
„ Winged		——	—
Broad-leaved	*macrophýlla*	——	—
Siberian	*Siberica*	Siberia	—
Saw-leaved	*serruláta*	N. Amer.	—
Wave-leaved	*unduláta*	Canada	—
Glaucous	*glauca*	N. Amer.	—
Red	*rúbra*	——	—
Dwarf	*púmila*	——	—
Heart-leaved	*cordifólia*	——	—

Eng. Name. Bot. Name.
BIRCH-TREE. BETULA.
Monœcia Polyandria. Linn.

[M]ALE FLOWER—scales of the *ament*, imbricated, shield-shaped, and three-flowered; *calyx*, one scale; *corolla*, none; *stamina*, ten to twelve. FEMALE FLOWER—*ament*, imbricated; scales of the *calyx*, two-flowered; *corolla*, none; *seed*, one, winged.

Time of sowing seed—Autumn or spring; to be kept in dry, cool sand, from the time it is ripe until it is sown. *Soil*—The birch will grow in every description of soil, from the wettest to the driest. *Uses*—The wood is chiefly used by the wheelwright and turner; it affords good charcoal; its soot is esteemed as an ingredient in printers' ink; the bark is of use in dyeing wool yellow; but the chief use of the tree is for underwood. The spring sap of the birch-tree has a saccharine quality, and is sometimes made into wine. The weeping birch is a very ornamental plant.

The common birch is found in the highest latitude or limits of the growth of trees. In the 70th degree of north latitude, its stature is reduced to that of a shrub, and it is singular thst the opposite extreme of a warm or dry atmosphere has a similar effect in preventing its growth. Michaux assumes the 45th parallel as the limit below which the common birch is only accidentally found in forests, unless on high elevated sites where the temperature is sufficiently low. Although the merits of the wood of the birch will not allow of its ranking as one fit for planting on soils where the more valusble forest-trees will attain to due perfection of growth, yet for certain poor elevated soils it is highly valuable, and on very wet or springy land it will be productive; there are instances known of its produce on soils so poor as scarcely to carry any thing else but moss, affording in ten years growth the value of ten pounds per acre. In the northern parts of Europe it attains to seventy feet in height, and two feet in diameter. In Sweden, Norway, and Finland the inhabitants avail themselves of its wood, bark, leaves, and sap, for a great variety of economical uses, for almost all the implements of husbandry, elegant articles of furniture, for bowls, plates, spoons, chairs, &c. The bark is used for the manufacture of boxes, baskets, and sandals; its durability is so great that it is used in preserving parts from decay by wrapping it round them. The Laplanders prepare the skin of the rein-deer with the bark. They cut the bark into small pieces, which they macerate, and afterwards boil in water, with the addition of a little salt. The skins are plunged repeatedly into this decoction warmed, and are allowed

to remain in it several days. They are then taken out, and rendered pliable and soft, and in this state they are scarcely permeable to water. In Russia, by slowly burning the bark in kilns, an empyreumatic oil is obtained with which leather is prepared, highly esteemed for durability. Evelyn enumerates a great variety of uses to which the birch is applicable, and Lightfoot gives details of its uses in the Highlands of Scotland. In America, the black birch is considered the most interesting of the species of that country. In some parts of the United States, it goes by the name of black birch; in Virginia, mountain mahogany; and in Connecticut, sweet birch; and in Canada, cherry birch. In deep loose soils Michaux has observed some seventy feet high, and two to three feet in diameter. The habit of this species is admired for its foliage, and its odoriferous flowers. In the Annals of the Arts a stock of this species is stated to have attained the height of forty-five feet in nineteen years. It is highly deserving a place in British forests.

The white birch, as it is called in America, or *Bétula Populifólia*, seldom rises to more than twenty-five feet in height. The distinctness of its foliage is its only recommendation at present known, for its wood is considered of inferior quality. The red birch of Michaux, or the *Bétula lanulósa* of our list, is chiefly found in Maryland, Virginia, and the upper parts of the Carolinas and of Georgia; it is seldom found farther north than New York. The epidermis of the bark of trees not exceeding eight or ten inches in diameter, is of a red or cinnamon colour, but on large trees (it sometimes attains to seventy feet in height) the bark is of a greenish hue. The twigs of this species are considered superior to those of any other species for the purpose of making brooms. The paper birch is considered by some to surpass the common species in size and value of its wood. In Canada, and the district of Maine, the country people place large pieces of the bark immediately below the shingles of the roofs of their houses, as it forms a lasting and very impenetrable barrier to the rains. Various articles are manufactured of it, such as portfolios, &c. which are sometimes embroidered with silk of different colours. When divided into very thin sheets, it forms a substitute for writing paper; but the most important use, Michaux observes, to which it is applied, is in the construction of canoes. To procure proper pieces of the bark for this purpose, the largest and smoothest boles are selected. In the spring two circular incisions are made several feet apart, and two longitudinal ones in opposite sides of the bole; after which, by introducing a wooden wedge, the bark is easily detached. These plates are usually ten or twelve feet long, and two feet nine inches broad. To make the canoe, they are stitched together with fibrous roots of the white spruce, about the size of a quill, which are deprived of the bark, split and made supple by immersion in water. The seams are coated with resin of the balm of Gilead fir. Great use is made of these canoes by the natives and French Canadians in their long journies into the interior of the country—they are very light, and are easily transported on the shoulders from one lake or river to another. A canoe calculated to carry four persons, with their baggage, weighs from 40 to 50lbs.—some of them are made to carry as many as fifteen persons*. Upon the whole, this species appears to be well worthy the attention of the British forest-planter of certain descriptions of soil. Of the other species of birch enumerated below, the last seven are of dwarf stature, and fit only for cover, or for the margins of woods; at least the experience that has as yet been had of their culture does not warrant any further recommendation of them at present; but with these, as with numerous other species of trees, extended experience, and careful observation of their properties, and most suitable soils, are wanted, before satisfactory conclusions can be arrived at, as to their relative or comparative values.

Timber or Forest Species.

BIRCH-TREE.	BETULA. }	Native of	Ft.
Common........	*álba*........	Britain ...	40

* North American Sylva, vol. ii., p. 88.

† The *Rhododéndron pónticum* is an instance to shew that a plant may be long known only for its ornamental properties. It was introduced into England in 1763, and it is only of late years that its value for underwood and cover, in sandy and peaty soils, has been discovered and taken advantage of.

BIRCH-TREE.	BETULA.	Native of	Ft.
Var. Warted	*verrucósa*	——	—
,, Weeping	*péndula*	——	—
,, Palmate-lvd.	*dalecárlica*	——	—
,, Eastern	*póntica*	Asia	
,, Large-fruited	*macrocárpa*		
Pubescent	*pubéscens*	Europe	
Poplar-leaved	*populifólia*	N. Amer.	
Tall	*excélsa*	——	
Woolly	*lanulósa*	——	
Yellow	*lútea*	——	
Black	*nigra*	——	
Daurian	*davúrica*	Dauria	
Paper	*papyrácea*	N. Amer.	
Soft	*lénta*	——	
Hornbeam-leaved	*carpinifólia*	——	
Carpathian	*carpáthica*	Carpathian Mt.	

Species for Ornament, Shelter, &c.

Oval-leaved	*ováta*	Europe
Alnus	*viridis decand.*	—
Shrubby	*fruticósa*	Siberia
Glandular	*glandulósa*	N. Amer.
Hairy-dwarf	*púmila*	——
Smooth-dwarf	*nána*	Scotland
Var. large-leaved	*macrophýlla*	
Dark	*tristis*	Kamtschatka

Eng. Name.	Bot. Name.
HORNBEAM-TREE.	CARPINUS.

MALE FLOWER—*ament*, imbricated; scale of the *calyx*, ciliate; *corolla*, none; *stamina*, ten. FEMALE FLOWER—*ament*, imbricated; scale of the *calyx*, two-flowered; *corolla*, three-cleft; *seed*, a nut, ovate, angular, furrowed.

Time of sowing the seed—Autumn. *Soil*—Poor clayey loams, incumbent on sand, and chalky gravels, are well adapted for the growth of the hornbeam. *Uses*—The wood (see page 9, *fig. f*) of the hornbeam, as its name would imply, is extremely tough, or flexible, and hard, and valuable for many useful purposes; but the tree being chiefly cultivated for underwood, few opportunities are offered to the carpenter to prove its value in large scantling. Its value for every purpose where the properties above mentioned are essential, such as mill-clogs, heads of beetles, stocks and handles of tools, yokes, &c., is well-known. Like the beech, it is good fuel, makes superior charcoal, and affords excellent potash. It grows in exposed situations, and on very poor, cold, thin, damp soils, where many other species of forest-trees would make little progress. The leaves continue to adhere to the branches long after vegetation in them appears to have ceased. This property renders the plant valuable for the purposes of shelter, whether when singly planted or in rows, to be cut as a hedge. On soils of the nature mentioned, the hornbeam should always have a place, if not exclusively, at least in a considerable proportion to other species of trees. The varieties of the common hornbeam, mentioned below, are not otherwise interesting to the forest-planter than as regards the effect of foliage, and as subjects illustrative of the laws of vegetable economy.

The American hornbeam is found wild as far north as Nova Scotia, New Brunswick, and Lower Canada. By the French inhabitants of Upper Louisiana it is called *Charme*. It never exceeds thirty feet in height, and its more ordinary dimensions scarcely entitle it to rank as a timber tree. The trunk is similarly fluted as that of the foregoing species.

Timber or Forest Species.

BETULINÆ. *Nat. Sys.*

Monœcia Polyandria. Linn.

HORNBEAM-TREE.	CARPINUS.	Native of	Ft.
Common	*bétulus*	Britain	30
Var. Oak-leaved	*quercifólia*	——	
,, Striped-leaved	*variegáta*	——	
,, Cut-leaved	*incisa*	——	15
American	*americana*	N. Amer.	20

Species for Ornament, &c.

Eastern	*orientális*	Levant	12

Eng. Name.	Bot. Name.
HOP-HORNBEAM.	OSTRYA.

Monœcia Polyandria. Linn.

MALE FLOWER—*ament*, imbricated; *calyx*, one scale; *corolla*, none; *filaments*, ramose. FEMALE FLOWER—*ament*, naked; *calyx*, none; *corolla*, none; *capsule*, inflated, imbricated; *seed*, one at the base.

Propagated in England by grafting on the common hornbeam and by layers. *Uses*—The wood of the hop-hornbeam, or iron wood of America, is heavy, compact, and tough, and is used in America, Michaux informs us, for levers, brooms, and scrubbing brushes; the latter are made by rolling back very thin slices of the wood, adhering to a piece of suitable dimensions. In America it is considered a tree of the third order as to size, rarely exceeding thirty-five feet in height, and twelve or fifteen inches in diameter. It is never found in masses, but scattered

in the forests, and is more common near Lakes Ontario and Erie, than elsewhere. The Virginian or flowering hop-hornbeam attains to a greater height than the former. It is a more ornamental tree, the leaves being larger and of a finer tint of green; the value of the wood is similar to that now mentioned.

Species for Ornament, &c.

HOP-HORNBEAM, OR IRON-WOOD.	OSTRYA.	Native of	Ft.
Common........	*vulgáris* ...	Italy	20
Virginian	*virginica* ...	N. Amer...	—

CUPULIFERÆ. *Nat. Sys.*

Eng. Name.	Bot. Name.
HAZLE-TREE.	CORYLUS.

Monœcia Polyandria. Linn.

MALE FLOWER—*ament*, imbricated; *calyx*, a scale; *corolla*, none; *stamina*, eight. FEMALE FLOWER—*calyx*, two-parted, lacerated; *corolla*, none; *styles*, two; *seed*, an oval nut, fixed in the calyx, which remains permanent.

Time of sowing—February: should be preserved in sand moderately dry, during the winter. If the fruit be an object, the best kinds must be propagated by layers. *Uses*—Underwood or coppice, which, being of under size, is applied to the purposes of making hoops, spars, forks, hurdles, withes, wattling, crates, &c., for which it is esteemed. It may be cut every seven years. Mr. Belcher, in Young's Annals, vol. viii. p. 186, mentions, that in Kent the best soil for the filbert is a strong loam, the fruit produced on which is large and not maggoty; and that an acre has sometimes been sold for 50*l*. They are generally planted at 12 feet apart, the intervening ground being occupied with green crops, the culture of which requiring the frequent use of the hoe, is productive of benefit to the filbert plant, which is kept pruned to the height of six feet, and the diameter of the bush thus formed to about the same dimensions. The Constantinople hazel attains to the size of a tree. It was introduced into England in 1665, by Mr. John Rea. Linnæus mentions a very large tree of it in the Leyden Garden, in 1736, sown there by Clusius, above a century before. It is too much neglected by planters in England. The raceme, or fruit-bunch, is very large in this species, and the individual nuts are twice the size of those of the common hazel.

Species for Ornament, &c.

HAZLETREE.	CORYLUS.	
Common........	*avelläna* ...	Britain
Var. White filbert	*álba*.......	—
„ Red filbert ..	*rúbra*......	—
„ Oval-fruited .	*ováta*......	—
„ Barcelona ...	*barcelonénsis*	Spain
„ Cobnut	*grándis*....	Britain
„ Clustered ...	*glomeráta* ..	—
Lambert's.......	*tubulósa* ...	S. Europe
Dwarf American .	*húmilis*	N. Amer.
Cuckold	*americána* ..	—
Common do.	*rostráta*....	—
Constantinople...	*colúrna*	Constan.

CUPULIFERÆ (*subordo third*). *Nat. Sys.*

OAK-TREE. QUERCUS.

Monœcia Polyandria. Linn.

MALE FLOWER—*calyx*, bell-shaped, half fine-cleft; *corolla*, none; *stamina*, five to ten. FEMALE FLOWER—*calyx*, bell-shaped, entire, rough; *corolla*, none; *style*, one; *stigma*, three; *seed*, a nut (acorn), ovate, cylindrical, fixed in a short hemispherical cup.

Time of sowing—Beginning of November; or if deferred till spring, lay them upon a cool dry floor, to prevent their sprouting or vegetating. *Soil*—A rich loam, with a clayey subsoil, brings the oak to the greatest perfection; but it may be profitably cultivated on almost every description of soil, except boggy or peaty. *Uses*—The value of oak timber is too well known to need any description here. It has already been mentioned at p. 24, that there are two species or varieties of the British oak, *Quercus robur*, which differ considerably from each other in the value of their timber. They are considered by some botanists as merely varieties, *Quercus robur* pedunculata, et *Quercus robur* sessiliflora; while others, as Sir James Smith, makes them distinct species, *Quercus robur* et *Quercus sessiliflora*. The footstalks of the fertile *flowers*, *acorns*, and *leaves*, afford the most obvious character of distinction: in the former or more valuable variety, the footstalks of the flowers and acorns are longer, while in the inferior variety the footstalks are very short, or scarcely perceptible. On the contrary, as regards the *leaves*, the footstalks of the *Quercus robur* are shorter than in those of the *Quercus sessiliflora*, and the body of the leaf is likewise

less equally and regularly divided. The Durmast oak, *Quercus pubescens*, has been considered a variety also, but having an inferior quality of wood, it is perhaps better to consider it a distinct species. The distinguishing character of this species is in having the under side of the leaf pubescent; in other respects it nearly agrees with the *Quercus sessiliflora*, in having the leaf and fruitstalks almost sitting, and the leaves less deeply indented. The leaves of the inferior species are also observed to hang longer on the tree; sometimes they continue all the winter, approaching towards the character of an evergreen. This last distinction, however, is not always to be depended on, as the soil and health of the individual tree influence its habit in this respect. In our own experience we have by no means found this inferior species, *Quercus sessiliflora*, and its near ally to the Durmast oak, *Quercus pubescens*, so common as the foot-stalked oak, *Quercus robur*; but, on the contrary, comparatively uncommon. Although there are not such clear and specific facts recorded of the comparative difference of value between the quality of these two species of oak, as to determine the exact amount of loss which is occasioned every time the acorns of the inferior species are used for planting, instead of those of the more valuable above mentioned, yet the general opinion being so strong in favour of the superiority of the foot-stalked oak, that it is of much importance to collect and sow the acorns of that species only*. We have already, at p. 23, 24, 25, described the mode of rearing the oak from the acorn on the spot where it is to remain for the production of timber; the soil on which it attains to great perfection (p. 49), and the best size of plants, from nursery rows, when the more general mode of rearing oak by transplanting is adopted (p. 34.) We have before also mentioned some oak trees remarkable for the perfection of growth they had attained; and did the limits of these pages permit, we could add greatly to the number from specimens which were, or are now in Earl Powis's Park, near Ludlow; Earl of Surrey's, Worksop; Lord Bagot's in Staffordshire; Lord Holland's, Ampthill Park*, Bedfordshire; Withy Park, Shropshire, Dennington Park, Berkshire, in the weald of Kent, New Forest, Hampshire, &c. These two species of oak constitute a considerable portion of the forests, from the sixtieth to the thirty-fifth degree of north latitude, extending over a portion of the north of Asia, and the northern point of Africa.

The common oak is considered to be the longest lived tree of the British forests. Those in the New Forest, mentioned by Mr. Gilpin in his Forest Scenery, v. ii. p. 63, which 'chronicle on their furrowed trunks, ages before the Conquest,' give an idea of the very great length of existence this species of tree is capable of maintaining; but for facts, on which to found a satisfactory conclusion of the average duration of vegetable life in this, and other forest-trees, we have only the test mentioned at p. 5, that of ascertaining the number of the concentric circles in the transverse section of the root, stem, or branch of the tree, and how-

* The specific botanical characters are, according to Sir J. Smith, as follows:—'*Quercus robur*—*Leaves*, deciduous, oblong, wider towards the extremity; their sinuses rather acute; lobes obtuse. *Fruit-stalks*, elongated.'—'*Quercus sessiliflora*—*Leaves* on elongated stalks, deciduous, oblong, with opposite acute sinuses. *Fruit*, sessile.'—Engl. Fl. p. 149—150.

The above discriminating characters are, according to our experience, as clear as the nature of the distinctions described will admit, but scarcely sufficient to constitute species.

* The circumference of one of these oaks at its base measures upwards of 40 feet, at its mean height about 30 feet: it is nearly hollow, and exhibits a concavity apparently sufficient to contain four or five middle-sized persons standing together withinside. The branches have been of very large dimensions, and one that still remains is equal in size to many a parent oak. The age of this tree must be very great, but the loss of the central wood will prevent the period of its age or duration being ascertained; and we believe there are no records of the planting of these oaks otherwise to determine this interesting point. The following lines are inscribed on a plate affixed to this remarkable oak:

Majestic tree! whose wrinkled form hath stood,
Age after age, the Patriarch of the wood;
Thou who hast seen a thousand springs unfold
Their ravel'd buds, and dip their flowers in gold,
Ten thousand times yon moon relight her horn,
And that bright star of evening gild the morn;—
Gigantic oak! thy hoary head sublime
Erewhile must perish in the wrecks of time.
Should round thy head innocuous lightnings shoot,
And no fierce whirlwind shake thy steadfast root,
Yet shalt thou fall; thy leafy tresses fade,
And those bare, scatter'd antlers strew the glade:
Arm after arm shall leave the mould'ring bust,
And thy firm fibres crumble into dust.
The Muse alone shall consecrate thy name,
And by her powerful art prolong thy fame;
Green shall thy leaves expand, thy branches play,
And bloom for ever in th' immortal lay!

ever satisfactory this test may be for this important object, it is but too seldom employed, if we are to judge by the few records of the ages of valuable trees, not only of the oak, but of all others of the first class of timber that are to be found. Were records of planting kept in the family archives of those who plant; containing the facts of the age of the plants, when transplanted to their timber sites, the nature and preparation of the soil at the period of planting, and the after culture until the trees attained to a timber size, the benefit to science and to practice would be great. (See note, * p. 11.)

The Turkey oak, *Quércus cérris*, was introduced into England in 1739. It is a handsome growing tree, and is perhaps the most valuable species next to the British oak. It will thrive on most kinds of soil; but a strong loam is that which it most affects. The wood exhibits all the good properties of that of the common oak; but the period of its introduction into England has not allowed of any sufficient trial to determine its comparative durability. It is highly deserving of a place in every plantation of forest-trees, where the soil is adapted to the growth of the oak, elm, and chestnut. The acorns are oblong, and the cup mossy. The leaves are deciduous, and readily distinguished from those of the common oak by their ovate-oblong shape and slightly flat-sinuate margins.

Michaux informs us, that there are forty-four species of oak found in America between the 20th and 48th degree of north latitude: of these he has described and figured twenty-six species*, which are all interesting for their different habits of foliage and growth; for general utility, however, there appears to be not one equal to our own native species, *Quercus robur.* The white oak before noted approximates nearer in valuable properties to the British oak than any other. In favourable situations it rises to seventy or eighty feet in height, and six or seven feet in diameter. To inquiries made to English, French, and American shipwrights, this intelligent author learnt that the general opinion agreed in the conclusion, that European oak was tougher and more durable from the superior closeness of its grain, but that the American species was more elastic, and required a shorter time, and only half the weight to bend it; and he judiciously adds, that this advantage, though important in ship-building, does not compensate for the openness of its pores. In America it is much used in the construction of mills and dams, where it is exposed to be alternately wet and dry. The wooden bridge—nearly three thousand feet long, that unites Boston and Cambridge—is supported by posts of white oak, from sixteen to twenty feet in length, which have replaced those of white pine, on which it originally stood.

The American mossy-cup oak has the lobe of the leaves so deeply indented as to give them the appearance of pinnate-leaves. The branches of the first and secondary limbs have a pendulous habit, which, with its generally handsome top, claims for this species a place in plantations. The quality of its timber has not been proved in England. In America it attains to sixty or seventy feet in height.

The over-cup white oak is distinguished for the largeness of the leaves. In

* His arrangement is as follows:—First, fructification annual, with lobed leaves.

White-oak............*quercus álba.*
European oak.........*róbur.*
European white oak...*róbur pedunculáta.*
Mossy-cup white oak..*olivæfórmis.*
Over-cup oak.........*macrocárpa.*
Post oak.............*obtusilóba.*
Over-cup oak.........*lyráta.*

Second:—Leaves toothed.

Swamp-white oak.....*díscolor* vel *Michauxii.*
Chestnut-white.......*palústris.*
Rock-chestnut........*montana* vel *monticóla.*
Yellow oak...........*acumináta* vel *castánea.*
Small chestnut oak....*prínos* vel *prinoídes.*

Division 2d. Fructification biennial; leaves mucronated, except the thirteenth species.

Section first—leaves obtuse or entire:—

Live oak..............*virens*
Cork oak..............*súber.*
Willow-leaved.........*phéllos.*
Laurel................*imbricária* vel *laurifólia.*
Upland................*cinerea.*
Running...............*pùmila.*

Section second—leaves lobed:—

Bartram oak...........*heterophylla.*
Water oak.............*aquatica.*
Black oak.............*nigra* vel *ferruginea.*
Bear oak..............*Banistéri.*

Third section—leaves multifid, or many cleft:—

Barren-scrub oak.....*quercus Catésbæi.*
Spanish oak..........*falcáta.*
Black oak............*tinctória.*
Scarlet oak..........*coccinea.*
Grey oak.............*ambígua.*
Pin oak..............*palústris.*
Red oak..............*rúbra.*

the United States they are found to measure frequently fifteen inches long and eight broad. The acorns are large, and the lips of the cup are frequently fringed with a series of flexible filaments. This tree is also deserving of a place in British plantations.

The lobed-leaved, or post oak, is a tree of a secondary size. Michaux states, that the preference given in the West Indies to the staves from Baltimore and Norfolk is due, in a great measure, to their being made of the wood of this species. It is an ornamental tree, but its merits for the produce of timber have not yet been proved in England.

The over-cup oak, or lyre-leaved, affects a moist soil, and is of a large habit of growth. The shape of the leaves and general habit of the tree render it interesting. It has not yet received in England the requisite time and culture to prove its properties for the produce of timber. In America Michaux states its height to be eighty feet, and its circumference eight to twelve feet.

The swamp oak, *Quércus díscolor*, is much less common in America than many of the other oaks. We have seen only one plant of it in England. Michaux describes it as a beautiful tree, more than seventy feet high; the leaves six or eight inches long and four broad, smooth and of a dark green above, and downy underneath. We believe this species to be nearly allied to the British durmast oak, *Quércus pubéscens*.

The chestnut white, or marsh oak, *Quércus Michaúxii*, is considered to be one of the most majestic trees of the American forests. It is described, according to the above, as rising to ninety feet in stature, with a straight clear stem of fifty feet, crowned with an expansive summit. The timber of it is considered inferior to the white oak, though superior to some other species. We have seen young trees only of it in England.

The rock chestnut leaved yellow oaks are as yet only distinguished for the shape of their leaves, which more or less resemble those of the sweet chestnut. The last mentioned is considered the most interesting. The acorns are of an inferior size, but of a sweeter quality than those of the other species mentioned. The small chestnut oak rarely exceeds thirty inches in height, and ought perhaps to have been passed over here without notice; however, it is very prolific, and where acorns are in request for the food of game, pheasants for instance, this dwarf oak may be planted with advantage. The acorns are very sweet. 'Of its habits in its native soil,' Michaux remarks, that 'Nature seems to have sought a compensation for the diminutive size of this shrub in the abundance of its fruit; the stem, which is sometimes no bigger than a quill, is stretched at full length upon the ground by the weight of its thickly clustering acorns.'

The live oak, *Quércus virens*, was mentioned at p. 45,* as highly deserving of a trial in situations on the southern coast. Michaux remarks, that it is never found farther than from fifteen to twenty miles from the shore. The eminent success of Mr. Lucas in transplanting trees of large growth of this species selected from the woods, on his estate at Middleburg, prove clearly its vivacious habits. It appears to be confined to the southern states of North America, *viz.* the Floridas and Louisiana, as its natural soil and climate, extending no farther north than Norfolk in Virginia. He further mentions, that in the course of four or five hundred miles between Cape Canaveral in East Florida, to Savannah in Georgia, he frequently saw it on the beach, or half buried in the movable sands on the downs, where it had preserved its freshness and vigour, though exposed during a long lapse of time to the fury of the wintry tempest, and to the ardour of the summer's sun. Its usual height in its native soil is from forty to forty-five feet, and one foot in diameter. The leaves are evergreen. The wood is extremely hard, tough, and very lasting. It is used for ship-building, screws, cogs for mill wheels, and other purposes, for all which it is preferred to the white oak.

The cork-tree, or cork oak, is a native of the south of Europe; it was introduced into England about ninety or a

* We here beg to correct a passage by inserting an omission at page 45, line 18 from the top; after the words, 'the live oak will not exist in England,' add, '*in elevated exposed situations*.'

hundred years ago*. It is found growing naturally in the south of France, in Spain, Portugal, and in some parts of the states of Barbary. It rarely exceeds forty feet in height and three feet in diameter. The wood is considered to be less durable than the common oak, although it is compact and heavy. Its growth in England is confined to warm sheltered situations. In exposed situations it cannot be reared. The largest we have seen in England is in the Royal Gardens, Kew, where its characteristic property, that of producing in perfection cork-bark, was, when we saw it a few years since, very evident and interesting. Abroad the cork is considered fit to be first taken from the tree when it reaches twenty-five years of growth, but this product is not of a quality to be used for better purposes. In ten years it is renewed, but it is not until the tree has attained to the age of forty-five or fifty years that the bark possesses all the requisite property for good corks. July and August are the seasons for taking it from the trees, which is carefully done, so as not to wound the alburnum; for should this happen (it may be unnecessary here to state), the cork bark is not again renewed on that part. The acorns should be sown as soon as received from abroad in small single pots, and shifted into larger as the roots increase, until the plants are from one to two feet high, when they may be transplanted for good; they may, however, be kept until they are six feet or more in height, provided care be taken to prevent the tap-root from passing down below the pot to any great length. The ilex, or evergreen oak, may be reared with advantage in the same manner as that now described. It is more hardy than the preceding tree. Its merits for ornament and shelter are well known; it appears to have been introduced into England from the south of France in 1581.

The kermes oak, *Quércus coccífera*, is worthy of remark here, although of so humble a habit of growth as not to attain the size which constitutes a timber tree. The scarlet, or red purple dye of the name, which supplanted the substitute obtained from a species of the *murex*, shell-fish, and used for the anciently celebrated Phœnician *purple* dye, is afforded by this oak-shrub (for the plant seldom rises above five feet, and often does not exceed two,) in the form of small red galls, caused by the puncture and subsequent deposition of the eggs of an insect, called *coccus ilicis*. This dye, in its turn, however, has been supplanted by the *cochineal cóccus cácti*, an insect itself, found on one or more species of the *cáctus*, or Indian fig, but more particularly the *Cáctus cochinillifer* or the *Opúntia cochinillífera*. The kermes oak is a native of the south of Europe, and was introduced into England about 1683.

Of the other species of oak enumerated below, the dyers' oak, *Quércus tinctoria*, demands notice, on account of its bark furnishing the yellow dye, *quercitron*, a substance much used in dyeing wool, silk, and paper-hangings It is the cellular integument of the bark that supplies the colouring matter. Doctor Barncroft states, that one part of *quercitron* is equal to ten parts of *woad*. It is stated, that to dye wool it is sufficient to boil the quercitron with an equal weight of alum; in dipping the stuff the deepest shade is given at first, and afterwards the straw-colour*. This species of oak appears to have been introduced into England as early as 1739; but its useful property now alluded to seems not to have been proved, or, in fact, tested in this climate. Its wood is considered inferior to that of the common oak.

Timber or Forest Species.

OAK-TREE.	QUERCUS.	Native of	Ft.
Common	*robur pedunculáta*	Britain ...	60
Sitting acorned ..	*sessiliflóra* ..	——	40
Woolly-petioled, or Durmast ..	*pubéscens* ..	England ..	—
Turkey-mossy-cups	*cérris*	S. Europe .	50
Var. Rough-lvd do.	*bulláta*	——	—
„ Nar.-lvd. do..	*sinuáta*	——	—
„ Fulham	*dentáta*	——	
Evergreen	*ílex*	——	—
Var. Notch-lvd. do.	*serráta*	——	—
„ Long-leaved .	*oblónga*	——	—
„ Lucumb's ...	*lucombeána*.	Levant	—
Champion red	*rúbra*	N. Amer.. .	80
Var. Mountain red	*montána* ...	——	—

* The Hortus Kewensis states it to have been introduced into England in 1699, by the Duchess of Beaufort.

* North American Sylva., i. p. 93.

Species for Ornament, or whose value for Timber of British growth has not yet been ascertained.

OAK-TREE.	QUERCUS.	Native of	Ft.
White*	*álba*	N. Amer.	70
Willow-leaved	*phéllos*	——	50
Live	*virens*	——	40 to 45
Ash-coloured	*cinérea*	——	18..20
Laurel-leaved	*laurifólia*	——	40
Var. Blunt do.	*obtúsa*	——	
Tile-cupped	*imbricáta*	——	40
Holly-leaved	*gramúntia*	——	
Cork-tree	*súber*	S. Europe	
Kermes	*coccifera*	——	2 to 15
Broad chestnut-lvd.	*prínus*	——	80
Var. Long-leaved	*oblongáto*	——	
Common water	*aquática*	N. Amer.	40
Var. Vari-lvd. do.	*heterophýlla*	——	20
„ Long-lvd. do.	*elongóta*	——	30
„ Entire-lvd. do.	*indivisa*	——	
„ Nar.-lvd. do.	*attenuáta*	——	
Black	*nigra*	——	30
Three-lobed	*trilóba*	——	
Downy-leaved	*elongáta*	——	
Dyers	*tinctoria*	——	90
Scarlet	*coccinea*	——	80
Marsh	*palústris*	——	90
Ilex-leaved	*ilicifólia*	——	
Gt. prickly-cupped or Velanida	*ægilops*	S. Europe	
Italian	*ésculus*	——	
Starred	*stelláta*	N. Amer.	40, 50
Lyre-leaved	*lyráta*	——	80
Grey	*boreális*	——	50
Bear-oak	*banistéri*	——	3, 4
Beech-like	*faginea*	S. Europe	
Hisped-cupped	*haliphléos*	France	
Soft-jagged-leaved	*Taúzin*	S. Europe	
Austrian	*Austriaca*	Austria	
Amer.-mossy-cup	*ovalæfórmis*	N. Amer.	
Clustred	*conglomeráta*	Europe	
Cypress	*fastigiáta*	Pyrenees	
Repaud	*repánda*	N. Amer.	
Cork-like	*pseúdo-súber*	Spain	
Over-cup-white	*macrocárpa*	N. Amer.	60
Barren-scrub	*catesbæi*	——	10, 20
Dwarf	*nána*	——	
Spiny-leaved	*agrifólia*	——	
Dwarf-chestnut	*prinoides*	——	
Yellow-chestnut	*castánea*	——	70
Swamp-white	*michaúxii*	——	80
Rock-chestnut	*montána*	——	40, 60
Two-coloured	*bicolor*	——	70
Turner's	*Turnerii*	——	
Levant	*infectória*	Levant	
Subdeciduous	*castelláña*	S. Europe	
Glossy-leaved	*lezermióno*	——	
Spreading	*expónsa*	——	
Calycine	*calycina*	——	
Portugal	*lusitánica*	Portugal	
Crenated	*crenáta*	S. Europe	
Running	*sericea*	N. Amer.	20in.
Sea	*maritimo*	——	*3,8

Cupuliferæ. Nat. Sys.

Eng. Name.	Bot. Name.
BEECH-TREE.	FAGUS.

Monœcia Polyandria. Linn.

MALE FLOWER—*calyx*, bell-shaped, five-cleft; *corolla*, none; *stamina*, five to twelve. FEMALE FLOWER—*calyx*, four-cleft; *corolla*, none; *styles*, two or three, three-cleft; *seeds*, an angular or three-corner shaped nut, one or two contained in each muricate capsule, which opens with four valves, and emits the seeds or nuts.

Time of sowing the seeds—from October to February: they require particular protection from field-mice and other vermin. *Soil*—Siliceous, sandy soils are well adapted for the growth of the beech; or it will attain a great size in elevated clayey loams incumbent on sand: it will prosper on chalky, stony, barren soils. *Uses*—It is used by cabinet-makers, turners, mill and wheel-wrights, for cogs, spokes, and felloes. In the dockyards it is used for wedges, &c. It is also used by musical-instrument-makers for sounding-boards, &c.; by coopers for clap-boards. Near large towns it is in great demand for billet-wood. It affords a large quantity of potash and good charcoal.

In Devonshire, where the severity of the western winds is great, the beech appears to withstand the bad effects better than most other kinds of trees, and this hardy habit of it renders it valuable for planting in high chalky and gravelly soils, where shelter is of so much importance to the surrounding lands. According to Vancouver†, the beech and sycamore are found most powerful to resist the rigour of the westerly gales. The nuts, or *mast*, of the beech afford an oil‡ by expression,

* The white oak is in high estimation in North America. Michaux states that the value of staves made of this species of oak received by England in 1808 amounted to 146,000 dollars, and the number of staves sent to the West Indies exceeded 53,000,000. The price has varied greatly within the last hundred years: 1720, three dollars a thousand; in 1798, eighteen dollars; and in 1808, thirty dollars. In 1807, before the American embargo, they were advertised at fifty-five dollars, and in 1808, after that municipal regulation, at one hundred dollars!

* Michaux, in his 'North American Sylva,' states, that there are found forty-four species of oak between the 20th and 48th degrees of north latitude of that continent.

† Survey of Devon, p. 251.

‡ It is considered next in fineness to the olive oil. According to Michaux, the forests of Eu and Crécy, in the department of the Oise, have yielded in a single season two millions of bushels of beech-nuts.—Ibid.

which the poorer inhabitants of Silesia are said to use as a substitute for butter. The nuts are sometimes roasted, and used for coffee. This tree is a native of the greater part of Europe, but is not found so far north as the northern provinces of Sweden. In England it prevails most in the range of chalk hills which run from Dorsetshire, through Wiltshire, Hampshire, Surrey, Sussex, and Kent, and more partially in Berkshire, Buckinghamshire, and Hertfordshire. It is not uncommon also on the Cotswold Hills in Gloucestershire, and in some parts of Monmouth. In Scotland, where its being indigenous is doubted, large plantations have been made, particularly by the Earl of Fife in Murrayshire, and by George Ross, Esq., of Cromarty. In certain cantons of Belgium, particularly near the village of St. Nicholas, between Ghent and Antwerp, very solid and elegant fences are made by planting young beeches seven or eight inches apart, and bent in opposite directions, so as to cross each other, and form a trellis. During the first season they are bound together by osiers at the points of intersection, and in time become grafted, forming apertures of four or five inches in diameter.

The bark of the American white beech is used for tanning leather, when there is a scarcity of oak bark: the leather made from it is white and durable, but inferior in this last respect to that tanned with oak bark. The purple or broad-leaved American beech is held in higher esteem in North America than the former. It is a hardier and a larger-growing tree. The timber is described as being less compact or solid than that of the English beech; planks of it, however, three inches thick, are exported to England. In summer, while the sap is in the vessels of the wood, it is considered a superior season for felling the beech to that of winter; and Michaux states that experience has demonstrated the fact, that the timber felled in the former season is greatly more durable than that which is felled in winter.

Timber or Forest Species.

Cupuliferæ. Nat. Sys.

BEECH-TREE. FAGUS.

Monœcia Polyondria, Linn.

Common........*sylvática* ...Britain ..,70

Species for Ornament, &c.

BEECH-TREE. FAGUS. Native of Ft.

Var. Purple......*purpúrea* ..Germany ,30
„ Golden stripe leaved....... } *foliis aúreis*
Copper-leaved....*cúprea*.....
Broad-leaved....*ferruginea* .N.Amer...40
White..........*sylvéstris*... —— 30
Fern-leaved......*comptoniæfol.* ——

Cupuliferæ. Nat. Sys.

Eng. Name. CHESTNUT. Bot. Name. CASTANEA.

Monœcia Polyandria. Linn.

MALE FLOWER—*ament*, naked; *calyx*, naked; *corolla*, five petals; *stamina*, ten to twenty. FEMALE FLOWER—*calyx*, five or six-leaved, muricate, or covered with soft spines; *corolla*, none; *stigma*, pencil-shaped; *seeds*, nuts, three, ovate, three-sided, enclosed in a roundish capsule, covered with soft spines.

Time of sowing the seeds—February.

Soil—A rich sandy loam raises the chestnut to the greatest perfection as a timber-tree; but it appears to come to great maturity in clayey soils, if free from stagnant moisture. It will thrive also in gravel or sand, if not in too bleak or exposed a situation.

Uses—The timber of the *castanea vesca*, or sweet chestnut (see page 9, *fig. e*), is said to be equal to that of the oak. For underwood or shelter, in a favourable climate, there can be no doubt of its great value, affording a fall in every ten or twelve years for hop-poles, hoops, &c. The chestnut, if not originally a native of Britain, has at least been long naturalized in the climate. The most ancient tree of this species on record is probably that mentioned by Bradley* in Lord Ducie's park, at Totworth, Gloucestershire. He states that, in 1150, it was styled the great chestnut of Totworth; and that, in 1720, it measured fifty-one feet in circumference at six feet from the ground. The same tree is mentioned, in 1791, by Lysons, who etched two views of it. This chestnut, it is highly probable, had lived a thousand years, and hence we may conclude its long duration in the soil. At Buckland, the seat of Robert Throckmorton, Esq., M.P., are to be seen some remarkably fine specimens of this tree; in several places in Kent, and on the banks of the Tamer,

* Gentleman's Magazine for 1766, p. 321. See also Martyn's Miller's Gard. Dict.

in Cornwall, all evincing the great perfection to which it arrives on a sandy, gravelly, or clayey loam. The wood, as already mentioned, is considered to be of equal value to that of the oak, and is applied to the same purposes: opinions, however, vary on the subject, and it is probable that the conclusions drawn from the supposed facts of the wood of the chestnut being found sound in very old buildings, are liable to some degree of doubt, inasmuch as a decisive proof of such wood being chestnut and not oak does not appear to have been brought forward. We have at pages 8 to 11 pointed out a certain means of identifying the wood of different species of trees. The value of the bark of the chestnut for tanning is inferior to oak bark, and the tree is not so hardy: with these deductions, and they are considerable, the two species of trees may be considered of equal interest to the planter. The value of the chestnut for coppice wood for the produce of hop poles, is well known. The varieties of the common chestnut mentioned below are very ornamental trees. The American chestnut differs but little from the English. It is most common in the mountainous districts of the Carolinas and of Georgia, and it does not appear beyond the 44th degree of north latitude. It flourishes, Michaux states, on the sides of mountains, where the soil in general is gravelly. The nuts are smaller and sweeter than those of the European species, and are sold at three dollars per bushel in the markets of New York, Philadelphia, and Baltimore. The wood is thought to be inferior to the European species. In France that of the common chestnut is held in high esteem for coppice wood: it is cut every seven years for small hoops, &c.; at fourteen years for large hoops, and at twenty-five for posts and light timber. Land so occupied, it is stated, yields a rent superior to that under other kinds of crops in the proportion of four to one. The Chincapin chestnut is not otherwise remarkable than for the beauty of its foliage and the diminutive size of its fruit.

Timber or Forest Species.

CHESTNUT.	CASTANEA.	Native of	Ft.
	vésca	England	50
	Americána	America	—

Species for Ornament, &c.

CHESTNUT,	CASTANEA.	Nativ of	Ft.
Var. Gold-striped	*vésca*	England?	50
„ Silver	—	—	—
„ Fern-leaved	—	—	—
„ Shining-leaved	—	—	—
„ Dwf. or Chincapin	*púmila*	N. Amer.	—

PLATANEÆ. *Nat. Sys.*

Eng. Name.	Bot. Name.
PLANE-TREE.	PLATANUS.

Monœcia Polyandria. Linn.

MALE FLOWER—*ament*, globe-shaped; *calyx*, none; *corolla*, scarcely perceptible; *anthers*, growing around filament. FEMALE FLOWER—*calyx*, ; *ament*, globular; *corolla*, many-petalled; *stigma*, recurved; *seed*, roundish, with a foot-stalk, terminated by an awl-shaped style, with a capillary pappas at the base.

Time of sowing the seeds—immediately after they are ripe, in a moist, shady situation, or by layers and cuttings in March. *Soil*—This tree prefers moist loam, but free from stagnant moisture. *Uses*—Except for fuel, the timber appears to be of little value. The trees are admired for their beautiful shade. The oriental plane is hghly praised by ancient writers. Ælian and Pliny extol it for the magnitude of its growth and beauty of form. It is generally believed that this tree was introduced into England by the great Lord Chancellor Bacon, although its introduction, according to Turner's Herbal, is set down as in 1562, or one year before the birth of that illustrious man; one thing is certain, that his plantation of it at Verulam first brought this tree into public notice. Its culture of late years has fallen into disrepute from the inferior quality of its timber. The American plane, or button-wood, is also a tree of large growth. Michaux measured one on the banks of the Ohio, whose stem, at five feet from the ground, gave forty-seven feet in circumference. This tree being more tender, or liable to be injured by the late spring frosts, has been sparingly planted of late years in England, and its wood is not of more value than the former.

Timber or Forest Species.

PLANE-TREE.	PLATANUS.		
Oriental	*orientális*	Levant	50
American	*occidentális*	N. Amer.	70
Spanish	*acerifolia*	Levant	

Species for Ornament, &c.

PLANE-TREE.	PLATANUS.	Native of	Ft.
Wave-leaved....	*cuneata*	Levant ...	50

Eng. Name.	Bot. Name.
SWEET GUM-TREE.	LIQUIDAMBER.

MALE FLOWER—*ament*, conical, common; *calyx*, or *involucre*, four-leaved; *corolla*, none; *filaments*, numerous. FEMALE FLOWER—*calyx*, in a globe, four-leaved; *corolla*, none; *styles*, two; *capsules*, two, enclosed at the base by the calyx, one-celled; *seeds*, many.

Time of sowing the seeds—Spring, in pots or boxes of light earth; to be shaded during summer, and protected from severe frost in winter: may be propagated also by layers. *Soil*—It will succeed best in a sandy loam, but will thrive in most kinds of soils of an intermediate quality between moisture and dryness. *Use*—Ornamental.

Species for Ornament, &c.

SWEET GUM-TREE.	LIQUIDAMBER.		
Maple-leaved	*styraciflúra* .	N. Amer.. .	30
Oriental	*imbérbe*	——	—

CONIFERÆ.

Subordo Taxineæ. Nat. Sys.

MAIDENHAIRED-TREE. SALISBURIA.

Monœcia Polyandria. Linn.

MALE FLOWER—*ament*, naked, filiform; *corolla*, none; *anthers*, incumbent, deltoida; FEMALE FLOWER—solitary; *calyx*, four-cleft; *seed*, a drupe with a triangular shell. Propagated by cuttings.

Time of sowing—Propagated by layers. *Soil*—A sandy loam. *Uses*—Habit of growth and ornamental foliage.

Species for Ornament, &c.

Maidenhair-tree . . *adiantifólia* . Japan . . . 20

YEW-TREE. TAXUS.

Diœcia Monadelphia. Linn.

MALE FLOWER—*calyx*, none, except a four-leaved perianth like a bud; *corolla*, none; *stamina*, many; *anthers*, buckler-shaped, eight-cleft. FEMALE FLOWER—*corolla*, none; *style*, none; *seed*, ovate, oblong, projecting with its apex beyond the berry, which is seated in a globular cup.

Time of sowing seeds—Autumn, as soon as they are ripe. *Soil*—Sandy loam; but it will also grow in most kinds of soil, particularly such as are chalky. *Uses*—Hedges for shelter. The wood is used by turners, inlayers, and cabinet-makers. It is much valued for flood-gates for fish-ponds, axletrees, cogs of mills, &c., bowls, wheels, and pins for pullies, and by turners for spoons, cups, &c. It has been disputed whether the yew is poisonous or not: the facts, however, in confirmation of the poisonous nature of the whole plant are too numerous to admit of rational doubt, and, consequently, great caution should be employed in planting it out of the reach of the more valuable domestic animals. That the berries have been eaten in very small quantities with impunity seems to be admitted; and also that sheep and goats, according to Linnæus, are less affected by taking it into the stomach, than horses and cows. The yew is a native of Britain, as well as of other parts of Europe, of North America, and Japan. The yew tree was formerly what the oak now is, the basis of our strength, for of it the old English yeoman made his bow,* as he now makes of the oak his seventy-four gun man of war.

The number of remarkable yew trees in different parts of the country are very interesting; and how much more so would they be rendered, had we records of the periods when they were planted! but we must, from want of space, refer the reader to Evelyn, Gilpin, Barrington in Archæologia. vii., xlviii., and liii., and to Martyn's Edition of Miller's Gardener's Dictionary on this point.

Species for Ornament, &c.

YEW-TREE.	TAXUS.	Native of	Ft.
Common........	*baccáta*	Britain ...	20
Var. Striped-leaved			
Upright or Irish .	*Hibérnica*...	——	

Eng. Name.	Bot. Name.
JUNIPER-TREE.	JUNIPERUS.

Suborda Cupressinæ.

MALE FLOWER—*calyx* of the ament, a scale; *corolla*, none; *stamina*, three. FEMALE FLOWER—*calyx*, three-parted; *petals*, three; *styles*, three; *pericarp*, or covering of the seed, a fleshy berry, irregular with the three tubercles of the calyx; *seeds*, three, bonelike, convex on one side and cornered on the other, oblong-shaped.

Soil—Light, silicious, sandy soils. *Uses*—The common juniper-bush is esteemed for its beauty as a shrub, and

* Gilpin's Forest Scenery, vol. i. p. 92.

likewise for its berries, which are used by distillers and rectifiers of ardent spirits. The plants are useful for ornament, when planted by the margins of woods. The red cedar, *Juniperus Virgiána*, attains to the size of a timber tree in deep sandy loam soils. In that part of Woburn Abbey Park called the Evergreens, said to have been planted by Miller, the celebrated author of the Gardener's Dictionary, are to be seen some remarkably fine specimens of this tree. In North America it is found wild as far as the forty-fourth and forty-fifth degrees. Michaux observes, that it becomes less common, and diminishes in size as it retires from the sea-coast. In favourable situations, as in the middle of small islands, and on the borders of the narrow sounds that flow between them and the main, it is forty and forty-five feet in height, and twelve or fourteen inches in diameter. The wood is fragrant and fine grained, strong and durable. In America, the wood is not plentiful, and is reserved for those more important purposes for which these properties are most required.

The white cedar* grows naturally in wet grounds in the marine lands of Maryland, Virginia, and New Jersey. There it attains to seventy and eighty feet in height. The wood is lighter than that of the red cedar, and is less durable. It is of slow growth in England, and even in its native soil, for Michaux counted two hundred and seventy-seven annual growths in a stem only twenty-one inches in diameter. The wood is fabricated into pails, wash-tubs, and churns.

Specise for Ornament, &c.

JUNIPER-TREE.	JUNIPERUS.	Native of	Ft.
Spanish	*thurifera*	S. Europe	
Tall	*excélsa*	Siberia	20
Red cedar	*virgimána*	N. Amer.	30
Savin	*sabina*	S. Europe	
Var. Striped-leav'd	*variegata*	——	
„ Tamarisk-lvd.	*tamariscifólia*	——	
Daurian	*daúrica*	Dauria	
Common	*commúnis*	Britain	
Var. Swedish	*suecica*	N. Europe.	
„ Brown-berried	*oxycédrus*	Spain	
Phœnician	*phœnicia*	S. Europe	
Lycian	*lýcia*	——	

* Properly belongs to *Thúja sphæroidea of Sprengel*, but ranked here according to Willdenow, under *Cúpressus thyoídes*.

JUNIPER-TREE.	JUNIPERUS.	Native of	Ft.
Scaly-branched	*squamáta*	Nepal	
Prostrate-Juniper	*prostráta*	N. Amer.	
Hemispherical	*hemisphærica*	Sicily.	
Oblong	*oblonga*	Armenia	
Daurian	*dáurica*	Dauria	

Eng. Name. ARBOR-VITÆ. Bot. Name. THÚJA.

Calyx, five-parted; *petals*, five; *capsule*, three-celled; *seeds*, solitary, very smooth, obtuse at the base, mucronate, and curved inwards.

Time of sowing the seeds—Spring, or as soon as the seeds are ripe. Sow in pots filled with a mixture of peat and loam. The plants are, however, generally propagated by layers—the first sort sometimes by cuttings. *Soil*—Moist, sandy loams suit these trees best: they however attain to fine trees even in damp clayey soils, or in dry sandy soils. *Uses*—They are ornamental evergreens for the fronts of plantations. The American arbor-vitæ is the only species which comes properly under the notice of the forest-planter. The value of the wood is considerable; it is slightly odorous, very light and soft grained. In Canada, according to Michaux, it holds the first place for durability. Fences made of it last three or four times as long as those of any other species. The leaves are made into a salve with hog's lard, and used in Canada for rheumatic pains.

Species for Ornament, &c.

ARBOR-VITÆ.	THUJA.		
American	*occidentalis*	N. Amer.	25
Var. Close-branched	*dénsa*	——	—
Chinese	*orientális*	China	—
Plaited	*plicáta*	NootkaSnd.	
Weeping	*péndula*	Tartary	
Lucas's	*Caroliniana*	Carolina	

CYPRESS-TREE. CUPRESSUS.

MALE FLOWER—*ament*, imbricated; *calyx*, of one scale; *corolla*, none; *anthers*, four, and sitting, without filaments. FEMALE FLOWER—*ament*, changing to a strobile; *calyx*, one-flowered; *corolla*, none; *stigma*, two, concave, points; *seed*, an angular nut.

Time of sowing the seeds—Spring, in a warm situation, or in pots, in dry light earth: to be kept in the cones until the period of sowing. *Soil*—This tree delights most in a sandy loam, but it will also thrive and grow to a considerable height in clayey soils. *Use*—Ornamental and economical, as regards the wood of the

evergreen and deciduous cypresses. The wood of the upright evergreen cypress is said to resist the attacks of worms, and all putrefaction for many years. Professor Martyn says, that the doors of St. Peter's Church at Rome were built of this wood, and which lasted eleven hundred years, or from Constantine to Pope Eugenius the Fourth's time. This tree deserves to be more attended to by the British planter than it is at present. The deciduous cypress attains to a timber size in England, although it is of slow growth. Having been hitherto planted with a view to ornament rather than to economy for timber, its merits have not been proved in England. In North America its wood is highly valued, and in Louisiana, it is said to be profitably substituted for the white oak and pine. It attains to the largest size in low, damp, or swampy soils, in the southern states, rising to one hundred and twenty feet in height, and from twenty-five to forty in circumference.

Species for Ornament, &c.

CYPRESS-TREE.	CUPRESSUS.	Native of	Ft.
Upright	*sempervirens*	Candia	20
Var. Spreading	*horizontális.*	——	—
Portugal, or Cedar of Goa	*lusitánica*	Portugal	—
White	*thyoides*	N. Amer.	
Com. deciduous	*distichum*	——	
Var. Long-leaved	*nútans*	——	
Twisting	*torulosa*	Nepal	

Eng. Name.	Bot. Name.
NORFOLK ISLAND PINE,	ARAUCARIA.

Diœcia Monadelphia. Linn.

MALE FLOWER—*ament*, imbricated; *calyx* a woolly scale; *corolla*, none; *anthers*, ten to twelve, in the scale connate. FEMALE FLOWER—*ament*, strobile-shaped; *calyx*, one-scale, spear-shaped, leathery; *corolla*, none; *stamina*, none; *seed*, a nut, leathery, wedge-shaped.

Time of sowing the seeds—In pots as soon as obtained. *Soil*—A sandy loam, in a warm sheltered situation. *Use* — Ornamental. The Norfolk island pine is a most magnificent tree in its native climate. In England it is properly a conservatory plant. How far it may be capable of being acclimated has not yet been determined. Of the Chilian species of *Araucária*, planted in the open air, there is a fine specimen in the Royal Gardens, Kew, and one at Lord Grenville's, Dropmore. Governor King states, that he measured some of the former species in Norfolk Island, which were two hundred and twenty-eight feet in height and eleven in diameter.

The wood is white, close grained, and tough, and it appears to contain no resin. The bark, however, affords a fluid partaking of the properties of that substance. *Lamb. Pin.*

Species for Ornament, &c.

NORFOLK-ISLAND PINE.	ARAUCARIA.	
Sir Joseph Banks's	*imbricáta*	Chili
Brazilian	*braziliána*	Brazil
Norfolk Island	*excélsa*	Norf. Isl.

Eng. Name.	Bot. Name.
PINE-TREE.	PINUS.

Monœcia Monadelphia. Linn.

MALE FLOWER—*calyx*, four-leaved; *corolla* none; *stamina*, numerous; *anthers*, naked. FEMALE FLOWER—*calyx*, scale of the strobile two-flowered; *corolla*, none; *pistil*, none. MALE FLOWER—scales of the *ament*, buckler-shaped; *corolla*, none; *anthers*, adhering to the scales, sitting, or without filaments. FEMALE FLOWER—*calyx*, scales of the *ament*, two-flowered; *corolla*, none; *pistil*, none. *Seed**, a wing nut.

Time of sowing the seeds—March: the seeds should not be taken out of the cones until the time of sowing arrives. *Soil*—All the fir and pine tribe affect siliceous, sandy soils, but they will flourish on rocky, and comparatively barren soils, for which they are peculiarly adapted. The *firs*, *pines*, and *larches* constitute a perfectly natural genus, or family of trees. The most obvious or ready character of distinction between them is to be found in the natural arrangement of the leaves. The *firs* have the leaves solitary, or issuing from one scale or sheath on the bark of the branches, over which they are scattered. The *larches* have their leaves in tufts, or little bundles, which are deciduous, and the *pines* have from two to five leaves issuing from one sheath at their base, and have the habit of an evergreen. One property is common to all the species of this genus, that of affording resinous matter, either from the wood, bark, or cones. The property of reproducing a leading stem or branch when divided, common to all other trees more or less, is wanting in this family of trees; and hence they are

* Sir J. Smith, in Comp. H. B.

called non-reproductive trees (see p. 33.) The universal use of the wood (page 10, *fig.* o.) renders its properties and comparative value so well known as to relieve the reader from details here on that point. The species which experience hitherto has proved to be most deserving of the attention of the profitable British planter are—

The *silver fir*, which attains to the height of one hundred and ten feet and upwards, with a proportionate diameter, in this climate.—(See pages 80—89.) It is very apt, during its first stages of growth, to have its young shoots cut by the spring frosts; and this circumstance, we believe, is the cause of the great neglect of planting this valuable fir. It has already been remarked, that it takes the lead of the larch, Scotch pine, and spruce after the first fifteen years of growth, and therefore its slower progress at first ought not to prevent its being more extensively planted than it has hitherto been in every situation where the fir, pine, or larch are proper to be planted for profit or ornament.

The *Balm of Gilead* fir in habit and appearance approaches near to the silver fir, but it is evidently inferior in every respect, although a very handsome evergreen tree. These two species are often confounded together*. The leaves of the silver fir are arranged nearly on opposite sides of the branch, comb-like. The under sides of the leaves have two white lines running lengthways, which give them a silvery hue. The leaves of the balm of Gilead are shorter, blunter, and stand nearly upright, in double rows, on the upper side of the branches; while, in the silver fir, they are flattened and irregularly single-rowed. According to Michaux, the resin of this tree is collected in America, and sold under the name of *Balm of Gilead*.

The Norway spruce is considered to attain from one hundred and twenty-five to one hundred and fifty feet in height. With the Scotch pine it is said to constitute the greatest proportion of the vast woods of Denmark, Sweden, and Norway. The timber is held to be inferior to that of the Scotch pine. The latter is called red deal, and the former white deal. This tree attains to a large size on cold damp clays, situated on declivities*. The white, black, and red spruces are of inferior value to the Norway. In America the wood of the black spruce is sawn into boards, and exported to the West Indies and to England; Michaux states that they are sold at one-fourth cheaper than those of the white pine.

The Scotch pine, *Pinus sylvestris*, whether as regards its hardy habits, growing in severe climates and in soils ungenial to almost every other kind of tree, or to its value in the production of useful timber, must stand in the first rank of forest-trees. The great elevation in which this tree will grow was mentioned before at page 44. A large exportation of the timber takes place from Riga, Memel, and Dantzic to England. In the former places, according to Mr. Lambert, it is called red deal, and in London yellow deal. According to respectable authority, this species furnishes four fifths of the tar consumed in the dockyards of Europe†.

The pinaster, having an inferior timber, claims but little notice from the profitable planter; however, it will grow in situations exposed to the sea air, and is an ornamental tree.

* Silver Fir—*Leaves* solitary, flat, emarginate, pectinate; *scales of the cone*, very blunt, pressed close.

Balm of Gilead Fir—*Leaves* solitary, flat, emarginate, subpectinate, almost upright above, never flat; *scales of the cones*, when in flower, acuminate, reflex.

* The resin, which concretes on the bark after a wound, being boiled in water, and strained through a linen cloth, is then called Burgundy pitch. By boiling the resin until the water is evaporated, and by then adding wine vinegar, the substance known under the name of *colophonium* is formed.

† In 1807 tar and pitch were exported to England from the United States to the amount of 265,000 dollars. The process of extracting the tar is nearly as follows:—The wood is stripped of the sap, and cut into billets two or three feet long, and about three inches thick. A circular mound is prepared, slightly declining from the centre to the circumference, which forms a shallow ditch. The diameter of the pile is proportioned to the quantity of the wood; to obtain one hundred barrels of tar the diameter should be eighteen or twenty feet. In the middle a conduit is made to the ditch, in which is a reservoir to receive the resin as it flows from the ignited mass. The top of the mound is coated with clay, and made hard and smooth, and on which the wood is laid in rays. The pile, when finished, is twenty feet at the base, and, at eight feet in height, twenty-five or thirty feet in diameter, terminating in a cone four feet above. It is then strewed with pine leaves, and covered with earth. It is ignited at the top similar to the process of charcoal making. The fire should act slowly, so that a pile of the above dimensions should continue burning eight or nine days. Pitch is tar reduced by evaporation.—Mic., Amer. Sylva., vol. iii. p. 142.

The stone pine is more celebrated for its seed, which is eaten as a fruit, than for the value of its timber. In Italy and the South of France the seed is served up in the dessert; and according to Sir George Staunton it is known and relished by the Chinese. It is a handsome tree.

The hooked pine, *Pinus uncináta*, is remarkable for the very high elevation of the site on which it will grow, mentioned at page 44. Those other pines belonging to this group, enumerated below, are all more or less interesting and deserving of notice; but as the facts relative to the comparative value of their timber are not yet sufficiently numerous to lead to satisfactory conclusions, we must necessarily omit any further mention of them here. The frankincense, Virginian, or pitch, swamp, and pond pines are all natives of North America. The most valuable of these in their native climate appears to be the swamp, or long-leaved pine, as Michaux terms it. He remarks, that its mean height is from sixty to seventy feet, with a diameter of fifteen or eighteen inches for three-fourths of its length. The timber of the swamp pine is extensively used in the Floridas, Georgia, and the Carolinas. It has not yet exhibited any merits as a forest-tree in the climate of Britain.

The Weymouth pine is of very quick growth in sheltered situations, and moderately moist sandy soils; but the timber is of a very inferior quality. It is extensively used in America, under the name of white pine; it is considered to have little strength, and affording but a feeble hold to nails. It is stated to reach the height of one hundred and fifty feet, and five in diameter.* It was cultivated in 1705, by the Duchess of Beaufort.

The Siberian stone or Cembra pine, is a highly ornamental species in England; but its merits for timber have not been satisfactorily determined. It abounds in the Tyrol, where the wood is preferred to common deal for flooring, wainscoting, and other kinds of joiner's work. It appears to have been confounded with the *Pinus pygmæa*, but the species are very distinct.

The *Pinus Lambertiána* was introduced in 1827, by Mr. Douglas, collector to the Horticultural Society of London. In its native soil, the north-west coast of America, it appears to be a tree of gigantic growth, and of great longevity. See (*) p. 70.

We come now to consider the last group or section of the pine tribe, or those with leaves disposed in tufts or little bundles surrounding a bud. The first and most valuable of these is the common larch. Scarcely any species of forest-tree has received so much attention and favour from planters, in a given series of years, as this tree; and our space will not allow of the simple mention of the names of the numerous eminent individuals, who have put its real and assumed merits to the test of trial, much less enable us to detail the various facts and opinions brought forward on the subject. Its merits are stated to have been known so early as the time of Julius Cæsar, who calls it *lignum igni impenetrabile*.* It is a native of the South of Europe and of Siberia, inhabiting the sides of the mountains, in the local hollows of which it attains to the largest dimensions. The first mention of its culture in England is given in Parkinson's Paradisus in 1629; and Evelyn, in 1664, mentions a larch tree of good stature at Chelmsford, in Essex. It further appears to have been introduced into Scotland in 1734 by Lord Kames. But the merit of making known its valuable properties as a timber tree for the climate of Britain, appears to be due to the Duke of Athol, who planted it at Dunkeld in 1741. The rapid growth of these and of other trees of the same species planted successively by that nobleman, and the valuable properties of the timber of such as were felled, realized the high character previously bestowed upon it by foreign and British authors, who were followed by others, such as Doctor Anderson, Watson, Bishop of Landaff, Marshall, Professor Martyn, Nicol, Ponty, Sang,

* The quantity of timber of this species of pine which passed down the Sorel for Quebec, between the 1st of May, 1807, and the 30th of July following, was 132,720 cubic feet of square wood, 160,000 of common boards, 67,000 feet of planks two inches thick, 20 masts, and 4545 logs. It is brought to the market of New Orleans from a distance of 2900 miles. At Liverpool, in 1808, the cubic foot was 60 cents, and planks of two inches by twelve four cents a foot.—N. A. Sylva, vol. iii. p. 171.

* Harte's Essays, Professor Martyn in Mill. Gard. Dict.

and Monteith, all confirming and further extolling the valuable properties of the tree, which has induced a somewhat general belief, that the larch is the most valuable of forest-trees, even taking precedence of the oak. It is no wonder, therefore, that the larch has been planted, and largely, in almost every kind of soil; and as it is not exempted from the influence of that natural law to which every other species of tree is subject, namely, that which restricts to peculiar soils the perfect development of all the parts of their structure and successful progress of growth to the state of full maturity or perfection—in msny instances plantations of it have failed in making a return of the expected advantages, inferior even to the Scotch pine, not to mention the oak, elm, and ash, of greater value on a similar soil. On soils of the nature alluded to, namely, wet clays, springy gravels, and wherever stagnant moisture could not escape, the larch, after attaining to eighteen or twenty-five years growth, gives evidence of premature decay, or a suspension of healthy progress of growth, and when felled exhibits unsound timber, commencing in the centre of the leading roots, and penetrating upwards into the body of the tree.—(See page 74.) The instances are numerous which have come under our own observation of the fact now stated; and we mention it, not with a view to detract from its intrinsic value, or to discourage its propagation, but as a caution against the indiscriminate planting of it in soils without exception or without due examination. On declivities, and even in hollows, where clays abound, but where there is also a drainage for the superfluous water, the larch we have found to attain to great perfection*. The pruning of larch and other non-reproductive trees was mentioned at page 66.

The comparative value of the red and black species of larch has not yet heen sufficiently proved; so far, however, as the trials have proceeded, the opinion is greatly in favour of the common or white larch.

The Cedar of Lebanon, *Pinus cédrus*, so celebrated by tne ancients for the valuable properties of its wood, such as continuing sound for a thousand or two thousand years, yielding an oil famous for preserving books and writings, destroying noxious insects, &c. has not been proved in the climate of Britain to afford timber of a valuable quality; it is also more difficult to propagate and of slower growth in its first stages from seed than the firs, pines, and larches to which it is allied: its culture, therefore, appears to have been confined in this country to parks and lawns, and doubtless there is no forest-tree that, when placed singly, or in small groups, confers such an air or impression of ancient grandeur and dignity upon a mansion and its grounds as a full grown Cedar of Lebanon. It is a native of the coldest parts of Mount Libanus, where now, according to the accounts of travellers, it is found in small numbers. Rauwolf, in 1575, saw only twenty-four sound trees and two old decayed ones. Maundrell, who visited the supposed site of this most ancient forest in 1696, could reckon only sixteen large trees, but many small ones. The largest measured twelve yards six inches in *girth* and thirty-seven yards in the spread of its branches. Professor Martyn remarks that Solomon's four-score thousand hewers must have considerably thinned the forest of Libanus. The same excellent author further observes, that we have now probably more cedars in England than are left on Mount Libanus—a fact which, when conjoined with that regarding the present state of the natural forests of America, mentioned at page 87, should afford matter for deep and serious reflection to those who have it in their power to plant land, comparatively waste or unproductive, in a judicious manner, but who hesitate thus to benefit their posterity and their country, from the fallacious impression that the natural forests of America aud of the north of Europe, unrenovated, as they continue to be from the neglect of planting, are inexhaustible, and will continue to supply the wants of the civil and navsl architectural sciences and arts of this country.

* Where stagnant moisture of the soil prevails, a comparatively great humidity of the atmosphere accompanies it, hence it is that the bad effects of unseasonable frosts or such as happen late in spring or early in autumn are always most severe on trees in such situations, and to which the larch is very obnoxious at that season when its shoots are in a young and tender state.

Forest or Timber Species.

First—Those with leaves solitary, scattered round the branches.

FIR-TREE.	PINUS.	Native of	Ft.
Silver	*picea*	Switz.	30—80
Balm of Gilead	*balsamica*	Virginia	50
Hemlock spruce	*canadénsis*	N Am.	10—30
Norway „	*ábies*	N. Europe	100
White „	*álba*	N.Am.	50—80
Black „	*nigra*	——	45—50
Red „	*rúbra*	——	30—50
Dwarf	*clanbrasiliána*	——	—
Oriental	*orientális*	Levant	—
Bushy	*dumósa*	Nepal	—
Yew-leaved	*taxifolia*	Columbia	—
Purple-coned	*spectábilis*	Nepal	—
Fischer's	*pichta*	Altay	—
Douglas's	*Douglásii*	N.Amer.	—
Double balsam	*Fraséri*	——	—

Second—Those with leaves in pairs, or two proceeding from tho base of a sheath.

PINE-TREES.	PINUS.		
Scotch	*sylvéstris*	Scot.	30—100
Cluster	*pináster*	S. Europe	60
Stone	*pinea*	——	40

Ornamental, or whose value as Timber-trees has not yet been ascertained in England.

Upright-coned	*púmilio*	Carniola	
Nodding-coned	*múghus*	——	
Pungent	*púngens*	N.Am.	40—60
Hodson's Bay	*banksiána*	——	60
Sea-side	*maritima*	S. Europe	40
Aleppo	*halepénsis*	Alep.	20—30
Jersey	*inóps*	N.Am.	40—50
American pitch-tree	*resinósa*	——	50
Corsican	*laricio*	Corsica	—
Hooked	*uncináta*	Pyrenees	—
Pallas's	*Pallasiána*	Crimea	—
Yellow	*lútea*	N.Amer.	—

PINE-TREE.	PINUS.	Native of	Ft.
Heavy-wooded	*ponderósa*	N.W.Am.	50
Gerard's	*Gerárdi*	Nepal	—
Crooked	*adúnca*	——	—
Roman	*Romána*	Italy	—
Siberian	*Sibérica*	Siberia	—

Third—Those with leaves varying from two to three.

Two and three-leaved	*variábilis*	N.Am.	40—60

Fourth—Those with leaves in threes.

Frankincense	*tæda*	N.Amer.	30
Virginian, or Pitch-pine *	*rigida*	——	80
Swamp	*palústris*	N.Amer.	60—70
Pond, or fox-tail	*serotina*	——	—

Fifth—Those with leaves in fives.

Weymouth	*stróbus*	N. Amer.	100
Siberian stone	*cémbra*, or *aphernoúsli*	Sib. Swit.	50—60
Lambert's	*lambertiána*	N.W. Am.	
Pigmy	*pygmæa*	Siberia	—
Bhotan	*excélsa*	Nepal	—

Leaves numerous in little bondles from the bottom or base of a sheath.

Timber or Forest Species.

PINE-TREE.	PINUS.	Native of	Ft.
Com. white larch	*lárix*	Switz.	50—80
Intermediate	*intermèdia*	Altay	
Dahurian	*dahurica*	Dahuria	

Species for Ornament, &c.

Black larch	*pendúla*	N.Amer.	30
Red larch	*microcárpa*	——	80
Cedar of Lebanon	*cédrus*	Levant	—
Indian cedar	*deodára*	Nepal	—

* Cultivated before 1759 by the Duke of Bedford Mill. Dict. Ed. 7. n. 10.

In looking over the above list of forest-trees, it may seem to require a reason for not arranging the names of the trees in alphabetical order, instead of adopting the natural system of classification mentioned at the commencement of this enumeration, at page 93; particularly as such a mode, under the circumstances of a partial selection from the whole of the vegetable kingdom, must necessarily, as there stated, exhibit a broken series of connexion between the individual families or groups of trees brought forward. The index, however, will supply this apparent inconvenience, and the advantages to the young forest-planter of being early acquainted with the affinities or natural connexions of different families and species of trees with each other, will, by a little experience in the practice of planting, be fully appreciated by him, should he even confine his examination to the structure of the seed, which is given in the botanical character of each genus or family of trees. The classes and orders of the Natural and Linnean systems, under which each genus of forest-trees stand, will also point out to him where may be found the discriminating characters of distinction of the different species, as in the Species Plantarum, or in systematically arranged

Floras, where such have been published, of the plants of different countries; and in the perusal of these, should a doubt occur, the above enumeration will show whether the tree or trees in question have been introduced into British planting. The height of the trees mentioned in the list is either such as we have ascertained by actual measurement, or have been assured of by respectable authority.

The advantages resulting to individuals locally, and to the whole community, from judicious planting, have been noticed at page 2, and subsequently in the course of these pages; and what judicious planting consists in, and what are the consequent profitable results from it, have also been pointed out by an appeal to facts obtained from culture, observation, and experience; which, if examined, can hardly fail to arrest the attention of those who have given little of it to this important subject, but who, nevertheless, possess the means thus to enrich their landed possessions in their own life-time, benefit their posterity, and their country. But it is not planting judiciously at first, it has been shown, that will accomplish those important results, without the essential addition of subsequent attention to skilful culture and management of the plantations throughout the entire progress of the trees to maturity, according to the purposes for which the produce of individual trees or species of trees are most valuable, and consequently their proper period of duration in the soil; these important points have been dwelt upon, and frequently urged in the course of these pages (16, 32, 61, 64, 66, and 45, 50, 67, 68, 71); and it may be here added, that there is more absolute loss to individuals who possess plantations, but who neglect the application of judicious culture to such, than accrues from the like neglect of the healthy progress of any other agricultural crop whatever. Besides, it is an evil, that this neglect leads to an erroneous opinion of the utility, and important private and public value of judicious planting, and induces many who have it in their power to plant extensively to omit it, and leave that land barren and waste, which might otherwise be so beneficially occupied in the growth of timber, and amelioration of defective local climates. The great extent of waste-land in this kingdom has been stated at page 85.

By referring to the county surveys, and to other sources of information, it will be found that a large portion of the waste, or comparatively unproductive lands, in this kingdom, is capable of being profitably employed in the growth of timber; and, taking the proportion of one-twentieth part only of the whole, there will be upwards of three millions and a half of acres available for the purpose, or say, one million and a half of acres for trees, and two millions of acres for conversion to down-pasture, or partly tillage, by the aid of the shelter and amelioration of the local climates produced by the judicious disposition of the plantations. The facts and observations brought forward in evidence of the public necessity for the extension of forest-tree planting, as well as the advantages accruing from it to private estates, need not here be repeated; neither need it be recalled to mind, that the perpetual consumption of timber from the natural forests of this country, without any aid being afforded in return to renovate or keep up a succession of trees by planting, at last caused that scarcity of timber for civil and naval architecture which first led to the culture of timber-trees as an article of profit, and which has brought the art of arboriculture to a higher degree of perfection in Britain than in any other country. But a similar consumption without renovation is now going on in those countries from which we fallaciously expect an inexhaustible supply of timber; and we cannot but press upon the attention of those in whose power it rests, and whose duty it is to provide more largely for posterity than our ancestry has provided for us, that with the more perfect knowledge now possessed of the art of planting, the large extent of fit, but unoccupied soil, and the superabundance of unemployed labourers, to effect the work to its fullest extent,—this important object ought to be forwarded with that zeal, energy, and skill, which have been already displayedby some few individuals, and have been uniformly attended with success.

ORNAMENTAL PLANTING.

In the preceding parts of this treatise we have confined ourselves almost entirely to planting for profit, and have merely enumerated with brief remarks those trees, which, though incapable of being cultivated with advantage in our climate for economical purposes, produce striking effects in landscape scenery, and are of great value in the adornment of parks and pleasure grounds. They are not for the most part scarce in the nurseries of Great Britain, yet as we have observed that the planting of exotic trees is comparatively neglected, a few pages may be not unprofitably occupied, in pointiug out such as seem peculiarly deserving of attention.

The beauty of English park scenery is universally admitted: the constant source of fresh admiration to foreigners, and of delight to ourselves, it may, perhaps, be briefly described, as the art of imitating, in small compass, the most lovely scenes of external nature. In a pursuit so fascinating, the most elegant mind may find amusement, the most active benevolence room in which to dilate. In eliciting from crude materials new forms of beauty; in opening tbe valley; converting the barren hill-side into wood; in expanding the lake, and clothing a once naked district with luxuriance, tbe worth of an estate is increased, health improved, and charity the most useful dispensed, for

> 'Hence the poor are clothed, the hungry fed,
> Health to himself, and to his children bread,
> The labourer bears.'

The general practice cannot be much improved, but some beauties of detail may be gained, by a more frequent employment of foreign vegetation. Every one is aware of the charming effect of the weeping willow: tbis is a case in point. The light ramifications of the Robinia contrast beautifully with the bolder form of the oak; the hiccory, or black American walnut, relieves the heavy masses of the elm; the lucid green of the Spanish chestnut is well opposed to the dinginess of the beech; and the brilliant tints of many North American trees when in decay add a new and remarkable feature to the autumnal landscape. But the interest arising from the adoption of foreign trees into domestic scenery is not confined to their picturesque effects. They remind us of the climes whence they come, of the scenes with which tbey were associated. In exploring a well-selected arboretum, tbe eternal snows of the Himalaya, the savannahs of the Missouri, the untrodden forests of Patagonia, the vallies of Lebanon, pass in review before us: we seem to wander in other climes, to converse with other nations.

Although few foreign trees become permanent with us, many bear our climate well, yet, tried by the test of spontaneous propagation seem not to be capable of perfect naturalization. No genus is of more frequent occurrence in England than the hardy lime-tree, of which at least three nearly allied species inhabit the continent. In European Russia they abound, aud supply the bark from which the mats so largely used in our gardens are made. Here, though with attention the lime may be raised from seeds, nothing is rarer than to meet with a spontaneous seedling, even near individuals of great size, covered with myriads of seeds, mature, but, by some unsuitableness of climate, bereaved of competent vigour

to rear themselves unaided by art. The common *English* elm, (Ulmus campestris,) which peoples the hedge-rows of our southern counties, rarely perfects its seeds in England, and propagates itself by suckers. So near to us as Paris, it finds a congenial climate, and ripens them plentifully. The horse-chestnut, a native of the mountain-chains of Asia Minor, tried by the same test as the lime-tree, that of spontaneous propagation from seeds, appears to be one of the few instances of an exotic tree perfectly acclimatized in England. Perhaps another instance may be found in the Turkey oak, (Quercus cerris,) and some cases exist among coniferous trees. But though the laws of nature forbid us to hope for the perfect naturalization of many trees of other climates differing but little from our own, they allow us to embellish our domains with the rich variety resulting from the elegance of their forms, and the diversity of their tints. We have already alluded to the tree usually called the Turkey oak, (Q. cerris,) a native of the middle elevations of the Papal states, Tuscany, and southern Italy: it is always distinguished by the Italian writers from the common oak, (Q. robur,) as the *cerro*. About the lake of Perugia, and the scene of the memorable battle of Thrasymene, it attains to enormous bulk, and is very picturesque in its form, though its branches are not so abrupt and angular as those of our native oaks. In England it seems to be perfectly at home, grows fast, and produces abundance of acorns, bears bleak exposures, and thrives in lighter and more silicious soils than suit the oaks of England. It retains its leaves far into the winter, a valuable property when shelter is desirable. There is, perhaps, cause for apprehending that it will not thrive so well in a confined or crowded, as in an airy situation. Mr. Atkinson, the eminent architect, having converted a specimen of good size, which he found at the seat of the Marquis of Downshire in Berkshire, has proved experimentally its valuable properties fur ornamental purposes in domestic architecture. Its wood is closer in its grain, bears a higher polish, is richer in colour, and more varied in its markings thsn the wood of our indigenous oaks, or that which is brought down the Rhine from the forests of southern Germany, and imported into this country by the name of wainscoat oak, being, in point of fact, the produce of the Q. robur, and Q. sessiliflora, and owing its peculiarities to a more rapid growth in a more genial climate. We cannot too strongly recommend this beautiful and fast growing tree to our readers, combining as it does beauty of form, rapidity of growth, and much indifference about its soil, with a constitution of singular hardihood. We have seen it thrive in exposures where our own native oak and beech became stinted. A sub-variety of the Turkey oak, or more probably a distinct species, is known in the nurseries by the name of the Fulham oak, (Q. dentata, page 111,) after the parent tree, a magnificent specimen, now growing in the nursery ground of Messrs. Whitley and Co. at Fulham: it is highly deserving of cultivation. The Luccombe oak, supposed by some to be a hybrid production between the Turkey and Cork oaks, but more probably an indigenous Spanish species, is a pyramidal tree, apparently of moderate growth, and almost an evergreen. The Cypress oak, (Quercus fastigiata, page 111,) a native of the Pyrenees, and of the mountains of Portugal, resembles the English oak in leaf; but is of habit probably unique in this genus, carrying all its branches upright like a Cypress or Lombardy poplar, a circumstance of some value in landscape planting. Q. tauza or toza, the Chêne taussin of the French, indigenous to the *landes* of Bourdeaux and sandy soils of the south of France, is of low growth, with a very indented leaf, pubescent on its under surface; it is said to trace much from its root.

The ornamental qualities of the ilex are universally appreciated; the cork-tree, whose singular beauty of form and foliage are the admiration of all travellers in southern Spain, too tender to thrive except in a few favoured spots in our southern counties, is sufficiently described in the list of forest-trees, (page 111.) But the oaks nf North America claim the deepest attention from the ornamental planter. Ranging through many degrees of latitude, and growing at very different elevations, consequently under much variety of climate, some of them are hardy with us, some tender; but all abhorrent of wet or clayey soils. Deprived of the cloudless sun aud high temperature of an American summer and autumn, they cannot ripen their shoots sufficiently to be frost-proof, except upon soils of a light and warm nature. Their foliage is beautiful, frequently singular: with the effect of their autumnal tints of crimson every British tree fails in comparison. We shall only advert to such of those described by Michaux and Pursh, as we believe to be calculated to succeed in this country. In the garden of the Pêtit Trianon, at Versailles, the favourite retreat of the ill-fated Marie Antoinette, a fine specimen of the willow-leaved oak, (Q. phellos,) is very ornamental; it is not unusual in sheltered villa gardens in the neighbourhood of London, but in an inland situation in Hampshire, elevated about 600 feet above the sea, its shoots have been killed every winter. Q. humilis, maritima, sericea, cinerea, (Pursh,) are all related to Quercus phellos, and probably tender. Q. imbricaria is hardy and very deserving of notice, on account of its beautiful, shining, almost entire leaves, little resembling the familiar appearance of the oak. Q. tinctoria, discolor, coccinea, alba, rubra, montana, olivæformis, all hardy upon light soils, all attaining to large size, all beautiful in their perfect foliage, are superb during its decay. Q. tinctoria, one of the largest and finest trees of the North American forests, produces the valuable material so well known in commerce as quercitron bark. An oak of great size and promise, with fine broad leaves, and immense acorns, (Q. macrocarpa,) was introduced by the late Mr. Lyon, from the state of Tenessee. We have seen it only in the high situation in Hampshire before mentioned, where it has been unable to ripen its shoots. Most of the oaks enumerated by Michaux, as varieties of Q. prinos, but by Pursh as distinct species, must be tender in England, except under very favourable circumstances; perhaps by grafting them upon the Turkey oak, thus furnishing them with roots of hardier constitution than their own, their shoots may be ripened with greater certainty. The oaks of Spain, upper Italy, Croatia, Bosnia, and Turkey, are very imperfectly known; some of them are allied to Q. cerris, but are sufficiently distinct to make it desirable that we should possess them. Mr. Walsh, in the Transactions of the Horticultural Society of London, vol. vi., describes an oak growing near Constantinople, (Q. pubescens,) as a fine and beautiful tree; its leaves covered with down beneath, and its branches when young, pendulous, like those of weeping willows. It is probable that interesting species exist in the unexplored and classical regions of Asia Minor, now by the advancing civilization of the Ottomans, and the improvement in their government, laid open to the researches of travellers. But by far the most curious additions to our oaks, perhaps to the arboretum generally, are to be derived from the mountains of the Himalaya. We earnestly invite the attention of individuals connected with India, to the vegetable treasures of this region; whose valleys, more elevated above the sea than the top of Mont Blanc, contain within their bosoms most interesting species of oak, birch, walnut, fir, cedar, and other genera of cold climates, calculated by their beauty to adorn our parks and gardens in the highest degree. Some

of these have been made known to us by the active researches of English botanists. Q. grandifolia, with immense shining leaves, equalling those of Magnolia grandifolia in size and texture, has been figured in Mr. Lambert's splendid work on the genus Pinus. Q. apicata, with entire leaves from six inches to a foot lung, and acorns numerously crowded upon an upright spike from ten to eighteen inches in length; Q. lamellosa, with firm leathery leaves, smooth and glossy above, mealy and nearly white beneath, sometimes a foot in length, and as much as five inches in breadth, are both figured in Dr. Wallich's magnificent work, the Plantæ rariores Asiaticæ, now in course of publication, and we hope of encouragement, commensurate to its extraordinary claims upon every lover of natural history.

The coarse foliage of the elm, in our opinion, degrades it from the first class of ornamental trees, but in some situations, particularly in deep and somewhat damp soils, it succeeds better than many, and grows to vast size. Its varieties are curious—the variegated leaved elm is not without merit—the weeping elm is sometimes picturesque—the small leaved Cornish elm is perhaps the most elegant. The American elms seem to be deserving of attention. Mr. Hodgson, a recent traveller in the United States, was much impressed with the stupendous stature of specimens of the ulmus Americana around the neat villages of New England.

The giant bulk and extraordinary beauty of the oriental plane tree (Platanus orientalis) have made it, in all ages, the object of marked attention. Every classical reader is aware of the favour with which it was regarded by the Greeks and Romans, the latter of whom, according to the Latin writers, carried their admiration of this beautiful tree so far as to occasionally irrigate it with wine. Hardly less beloved by the Turks in modern days, it is with them a usual practice to plant one at the birth of a son. In the court of the Seraglio, as we are told by Mr. Walsh, is a venerable specimen, planted by Mahomet the Second, after the conquest of Constantinople, in commemoration of the birth of his son Bajazet the Second; it is now fifty feet in girth, the increment of three hundred and seventy years. At Buyukdéré, on the Bosphorus, is another of almost unequalled size: it stands in a valley, and is forty-five yards in circumference, but, in fact, now consists of fourteen large trees, growing from the same root-stock, coalescing near the ground, but, at some distance from it, diverging into distinct trunks. The oriental plane is indigenous throughout Asia Minor, ranging to a considerable elevation, but attaining its greatest size upon low levels and in deep soils. The specimens, whose remarkable bulk has conferred upon them an almost historical notoriety, are all situated not much above the level of the sea. In England this tree is perfectly hardy, and of the first beauty. It is remarkable, that though introduced here three hundred years ago, under the auspices of Lord Chancellor Bacon, it has been comparatively neglected since the introduction of the North American plane (Platanus occidentalis), which, being propagated with much greater facility from cuttings, has long been in almost undivided possession of the nurseries. Much inferior to the Oriental in beauty of leaf, though, according to American writers, not in size or majesty, the occidental plane, which attains its utmost luxuriance in the warm valleys of the Ohio, and upon the limestone soils of Kentucky and Tenessee, has proved incompetent to contend with our spring frosts, our sunless summers, and our clouded autumns. About twenty years ago, a great proportion of all the individuals in England, without respect of age or bulk, were killed outright by a late spring frost. Since then we have seen them repeatedly injured, and, when half recovered by the

operation of a summer of more than average warmth, again replunged into the same state of debility, whilst the oriental plane has remained quite uninjured. The intermediate species (P. cuneata, P. acerifolia) seem to be hardier than the American plane, but less so than the oriental plane.

Another American tree, of large stature, high beauty, and hardihood, is the tulip tree (Liriodendron tulipifera), which, as its name imports, unites the charm of abundant pale yellow flowers, bearing some resemblance to tulips, with beautiful broad leaves, of very ornamental form and colour. When placed near the American oaks, its foliage contrasts with them finely, particularly when, in autumn, it opposes its yellow tint to their shades of crimson. It is perfectly hardy, and becomes a large tree in England when planted in dry and deep soil.

Though our principal object is to treat of exotics, yet we cannot avoid mentioning the lime-tree, one of our most stately forest trees. Naturalists decide that three species are natives of England; but that which has the fairest pretensions to be so considered, according to the authority of Sir James Smith, Tilia parvifolia, is far less common in parks, than its congeners, though, in our opinion, it excels them in beauty. The North American species are very soft-wooded trees, and, in this country, of small stature: we have observed a very extensive gangrene, sometimes extending several inches down the trunk, to follow frequently upon the amputation of one of their branches, even of moderate size. They deserve little attention, except perhaps Tilia heterophylla, introduced about twenty years ago by Lyon, the industrious collector. Tilia alba, said by some to be a native of Hungary, a round-headed, thickly branching tree, of rapid growth, and somewhat formal outline, with broad leaves, green on their upper, and white on their lower surface, an attribute well displayed when they are agitated by wind, possesses the merit of being almost the latest deciduous tree to drop its leaves at the approach of winter.

We briefly advert to the Spanish chestnut, so superb in its stature, in one memorable instance, in this country, reaching to a girth of above fifty feet*; so beautiful in its foliage, so stately in its maturity, so venerable in its age, so rapid in its progress on warm gravels or deep fertile sands, together with its elegant variety the fern-leaved chestnut of the nurseries, and pass on to that delightful exotic, whose tumid bud is the well-known harbinger of spring, whose magnificence is perhaps undervalued, because it meets us in every walk, the horse-chestnut, the Æsculus hippocastanum of botanists. A species nearly related to it, if indeed it be not a mere variety, Æsculus rubicunda, with fine red flowers produced apparently in great abundance, should be universally planted. It has been lately introduced, along with Æsculus rosea, of nearly equal beauty, from the continent, where greater attention appears to have been paid to trees than in this country. Æsculus flava and neglecta, with flowers of but moderate beauty, are elegant in foliage and habit; the flowers of Æsculus Pavia are high coloured, though small; several other hardy species are rather shrubs than trees. But all of them deserve distinguished places in the arboretum or garden, and should, if possible, be raised from the nut. Generally they are propagated by budding upon the common horse-chestnut—an operation of great facility; but, in such case, the stock is apt to swell in a ratio much greater than the graft, becoming, not only unsightly, but rendering the specimen short-lived.

The whole genus Betula is ornamental, yet perhaps the most beautiful species it contains is our common birch (Betula alba), and its variety or kindred species, the weeping birch. These trees are of much too rare occurrence in park scenery; they are picturesque in outline, light

* Vide page 117.

in foliage, silvery in bark, very effective when disposed in groups, and contrasting finely witb the heavier forms of our native larger trees, but, like almost all trees of small growth, too apt to be neglected. The American species exceed them in size, but are inferior to them in elegance. They are nevertheless most interesting trees, and sbould be in every collection. With their tough bark, which is readily detached in large sections, the North American Indians roof their houses, and manufacture a variety of domestic utensils. Of it are formed those light canoes which float the Canadian over tha vast lakes, or down tha rapid rivers of his native regions, at one moment bearing along tbe trader, his valuable cargo, and adventurous companions; at tha next moment carried upon their shoulders across tha intarvenient portage. It is not too much to say, that, without tba assistance of tbis invaluabla material, the fur trade would bave been confined within narrow limits instead of pervading half a continent; and the progress of geographical discovery, the long labours of a Hearne, a Mackenzie, and a Franklin, would have been incompleta for another century.

A near relation to tha birch is the neglected alder, neglected because common, and rarely seen, except in the shape of coppice-wood, yet reaching, in favourable situations, to a size not generally suspected. At Gordon Castle, in Bamffshire, some exist of extraordinary stature, when seen at a distance, having much the appearance of oaks. Three of them, which are described by Joseph Sabine, Esq., in the Seventh Volume of tha Transactions of tha Horticultural Society of London, measured, one, seventy-one feet high and niue feet four inches in girth; one, sixty-ona feet and a half higb and seven feet four inches in girtb; and another, fifty-eight feet high and eight feet in girth, tha girth being taken at five and six feet from the ground. To those who wish for trees capable of enduring abundant moisture, we recommend the cut-leaved alder (Alnus glutinosa, var. laciniata) a derivativa apparently of equal size, and of growth as rapid as its type, which it greatly excels in elegance; several other curious varieties of the common alder are to be found in tha nurseries. Alnus quercifolia is probably of smaller growth, and the habit of Alnus oxyacanthifolia appears to be feeble; but Alnus cordifolia of southern Italy is a fine ornamental and hardy tree. There are soma other species, rather shrubs than trees, which may be used advantageously in moist localities, where a low growth of definite height is desirable.

We attribute the comparative disuse of the common ash in park scenery, and its rare occurrence as an insulated specimen, to the extreme avidity with which it is attacked and barked by deer, those enemies of the planter. Yet it is a tree of singular elegance, both in itself, and contrasted with trees of heavier foliaga: It grows to immensa size, attains to great longevity, and when old is strikingly picturesque in outline, in bark, and in the almost horizontal disposition of its main branches. The entire-leaved ash (Fraxinus simplicifolia) is an interesting variety; tha weeping ash (F. excelsa, var. pendula) is well known, yet hardly enough appreciated. When large, it is remarkably beautiful, but it must be planted in an inclosed spot, free from tha approach of cattle and sheep, who, by browsing upon its pendulous branches, would destroy the whole beauty of the specimen, and irretrievably check its growth. Fraxinus ornus, the flowering ash, is a beautiful small tree, especially in early spring, when in flower. Fraxinus lentiscifolia is a charming small tree; most of tbe American ash are fina in foliage, and deserve a trial in tha arboretum. Many of them exist in the Jardin des Plantes at Paris, where they cannot fail to attract the attention of any person interested in forest trees.

The common walnut—disfigured in England by spring frosts, coming late into leaf, and losing the whole beauty of its foliage prematurely in autumn —cannot be termed picturesque here, whatever it may be in the warm valleys of Switzerland and Upper Italy; but we hardly know a more picturesque tree than the black American walnut (Juglans nigra), which, in North America, is one of the most stupendous inhabitants of the forest. It is quite hardy, and of moderately quick growth, but certainly possesses the fault with which we have just reproached the common walnut, of tardy leafage in the spring. Its pinnated foliage is much more dense and tufted and of a livelier colour than that of the common ash. With the remaining American species we are not acquainted, but it would appear, from the statements of travellers, that none of them are trees of great beauty.

Several species of MAPLE claim the attention of the ornamental planter; a few are large trees; the greater portion are of small growth, and upon that account are, in our opinion, of great value in the creation of park scenery, where the object being to produce much effect in moderate space, it is frequently desirable to impart artificial height to small elevations, by crowning them with high trees, and, at the same time, to occupy the low grounds and middle distances with trees of humbler stature. It is in this point of view that the genus Maple, of which we are treating, is of importance. The common maple (Acer campestre) is rarely planted, and comparatively unknown as an ornamental tree, though few objects are more beautiful than it is when old, and arrayed in its bright yellow autumnal livery. The Norway maple (A. platanoides) excels the common maple but little in height, and is rather remarkable for its sturdy formal character. In early spring, just before the appearance of its leaves, it is covered with a multitude of yellow flowers; in autumn, when in incipient decline, few trees can contend with it in beauty; its leaves assume decided but various colours, singularly effective, owing to the distinct masses in which they are apt to arrange themselves. Whilst the greater part of the tree remains green but little faded, a whole branch suddenly becomes dull red, then another mass bright yellow, a tint which, gradually creeping over the whole foliage, is the forerunner of its fall. The ash-leaved maple (A. negundo), somewhat loftier than the Norway maple, and not possessing its formality, requires especial notice. Hardy, free growing, and graceful, when placed, as we are in the habit of seeing it, near trees of sombre hue, the very vivid green of its light foliage stands out distinct and brilliant, offering one of the best examples of the great beauty to be attained, by bringing into contrast trees of different tints. Several of the American maples are beautiful small trees; the sugar maple is of large growth, and curious from its valuable economical properties; but the most interesting species of this genus is A. macrophyllum, a huge tree, with broad leaves and most valuable dense timber, which has been lately introduced from the banks of the Columbia in North Western America, a region of stupendous vegetation, by Mr. David Douglas, the enterprising collector of the Horticultural Society of London. A. circinatum of the same country, also introduced by him, is a very handsome small tree, with deeply incised leaves, the graceful habit of which very much attracted his attention during his investigation of these countries.

The merits and demerits of the common BEECH, its peculiar adaptation to calcareous and dry gravelly soils, and the great bulk it attains upon them, its somewhat formal and little varied outline, its heavy autumnal tint, are too well known to detain us here; but we must not pass, without notice,

its curious but puny variety, the fern-leaved beech (Fagus Comptoniæfolia), nor its very remarkable variety the purple beech, whose leaves in early spring of blood red hue, in summer uniform dull purple, are too singular, (having, we believe, no parallel among hardy trees, except a remarkable variety of hazel,) not to ensure it a place in every collection. Situations may be found in the neighbourhood of ruins, or the recess of a secluded grove, where it may be employed with happy effect. We have found the North American beech not to succeed in our climate in dry calcareous soils; and they are described by Pursh as growing upon rich deep levels. Some most interesting species exist in Patagonia and in those regions, which every effort should be exerted to procure. Perhaps the greatest desiderata in British parks are evergreen trees, not being of spiral forms. The cedar of Lebanon, the evergreen oak, and the yew, begin and end our list of such. But Captain King, in his recent arduous survey of Terra Magellanica, that region of storm, of snow, and glacier, found, we believe, three species of beech in those countries; two of them he mentions by name, Fagus antarctica and Fagus betuloides. The latter, an evergreen tree of frequent occurrence, was met with in peculiar abundance in the neighbourhood of Cape Famine: trees of three feet in diameter were plentiful, of four feet there were many, and one was measured by Captain King, which maintained a girth of seven feet, as high as seventeen feet from the root, and then diverged into three immense limbs, each of them being three feet through. Live specimens of those trees were brought to England by Captain King, but have unfortunately, we hear, been lost. Every effort should be made to re-introduce objects of such interest. The true Winter's bark, (Wintera aromatica,) a native of the same inclement countries, is also an evergreen tree of small stature, but on every account interesting. It is most probable, that many important acquisitions to our shrubberies are to be found in the same regions. Fuchsias of great beauty were discovered growing to be considerable shrubs in the vicinity of perennial snows; barberries producing excellent fruit for tarts; veronicas of great size. We mention these facts, in the hope of directing attention of amateurs to these countries generally, including the southern parts of Chili, and the archipelago of Chiloe.

Pursuing our immediate subject, we must not omit to mention a very beautiful tree resembling the sumach in leaf, Ailanthus glandulosa, a native of China, which, to singular beauty of foliage, unites great hardihood. It has the defect of coming into leaf perhaps the latest of any hardy tree; but compensates in some measure for this fault by its extraordinary gracefulness. It is easily propagated by cuttings of the roots.

The Robinia pseudacacia, or locust tree, is universally known and appreciated as being singularly well adapted to garden scenery. Rapid in its growth when young, it seems to lessen its pace materially, after twenty or thirty years, apparently in consequence of its roots penetrating into a colder subsoil, and it appears to be short lived on chalk soils. We do not think it likely to become a large tree in England, except in a few very favoured spots. Its timber possesses great durability. The various species of sweet locust, or Gleditschia, are slender trees of elegant pinnated foliage, and derive some interest from the very remarkable thorns investing some of them: they are rather garden than park trees, and require deep soil, together with a warm substratum. The same remarks as to soil apply to the genus Celtis, or nettle tree. In England we have rarely met with a good specimen; in France we have seen them of great elegance.

The willow tribe affords us one exotic of pre-eminent beauty, the Salix

Babylonica, or weeping willow. It adorned the banks of the Euphrates in the days of prophecy, and has been rendered memorable by its connexion with the captivity of the house of Israel. As might have been expected from its Assyrian origin, it is somewhat tender, and in high situations is liable to be injured by spring frosts. Nothing can exceed its beauty when properly applied. Hanging over a rock, jutting from a promontory, or reclining over an urn, few objects in nature more delight the eye of taste. The common white willow, (Salix alba,) is a tree also of great beauty, but strangely overlooked, being generally degraded most unworthily to the condition of a pollard. It grows, when indulged with its favourite situation, a deep rich soil by the side of water, to a very large size; and so placed, we have seen it attract great notice by the fine contrast between its slender silvery leaves, and the dark foliage, and dense masses of the oaks and beeches which crowned the adjoining heights. Such an example is to be found on the banks of the lake at the Grange in Hampshire, the magnificent seat of A. Baring, Esq.

No other species of willow is of equal importance in ornamental planting; but the POPLAR tribe must not be overlooked. Amongst its species, the most important, as an ornamental tree, is also the one which, because it is of the most common, hacknied occurrence, has hardly escaped the reproach of vulgarity. Yet how beautiful is the spiral Lombardy poplar when judiciously used, and when, being planted in rich deep soil, and forced into something like the bulk which it reaches in its native climate, it is tastefully contrasted with large trees of rounded forms, and its clear fine green at the same time brought into opposition with their heavier tints! Next in point of ornament is the English black poplar. The aspen derives some interest from its tremulous leaves, agitated by the slightest breath of wind; the Canadian poplar from its habit intermediate between the pyramidal Lombardy poplar, and the spreading black poplar; and the Ontario poplar, lately introduced, from its very ample leaves and singular rapidity of growth. The other species are rather subjects for a general collection, and cannot be described as decidedly trees of ornament; but the very rapid growth of the black Italian poplar, which is not a native of Italy, nor a variety of Populus nigra, but an indigenous North American species, fits it, in a peculiar manner, for many purposes of ornamental planting. The hornbeam can scarcely be deemed an ornamental tree, yet, where individuals of small growth are requisite, it may be advantageously employed. Its varieties are curious in foliage, and are more graceful than their type.

The few deciduous trees which remain for us to mention are rather garden than park trees, and require every advantage of soil, shelter, and protection: among these the genus Magnolia stands pre-eminent. Three species only can be considered as trees in this climate, and one of them, (M. grandiflora,) the loveliest tree perhaps of temperate climates, whether for its lucid foliage, or its superb and fragrant flowers, though growing in its native climes to the stature of eighty feet, with us is a small tree, under twenty feet in height, not reaching even this elevation except in sheltered spots, and within the protection and reflected heat of walls. M. acuminata, a deciduous tree, not gifted, as most of its race, with showy or fragrant flowers, possesses a splendid leaf, is much hardier than M. grandiflora, and grows in England to be a larger and loftier tree. M. auriculata, strictly a garden tree, is slender in form, spiral in habit, and elegant in foliage, every branch being terminated, in a healthy specimen, with a handsome and fragrant flower. The other hardy species, except perhaps Magnolia conspicua, are rather large shrubs than trees, though, under favourable circumstances, some of them reach to considerable

height. The Himalaya contains within its recesses a noble and lofty tree of this genus, M. excelsa, magnificent in its foliage and bulk, and covered, when in bloom, with innumerable splendid flowers. Liquidamber styraciflua is a small, but interesting garden tree. Koelreuteria pinnata, a native of China, comes under a similar class; but is entitled to much consideration on account of its very elegant pinnated leaves, and feathery flowers profusely produced in warm autumns, and occasionally succeeded by ripe seeds, from which we have propagated it. The very exotic foliage of Salishuria adiantifolia, the maidenhair tree, ought to ensure to it a place on every lawn; higher claims to distinction are possessed, in our opinion, by Virgilia lutea, a small tree of peculiar beauty of form and foliage, introduced about twenty years ago, from the mountains of Tenessee, by Mr. Lyon, and still uncommon in the nurseries. It has not yet produced its elegant papilionaceous flowers in this country, though we have heard that they have been seen at Paris. We must not omit to mention an indigenous tree, which, delighting in chalky soils, should never be overlooked by any person residing upon them, the white beam, (Pyrus aria.) The whiteness of the under surface of its leaves and the wildness of its habit are valuable properties, but indifferently shared by its near relation, Pyrus intermedia. The value of the common hawthorn in park scenery, and the remarkable union which it exhibits of beauty of flower with picturesque rudeness of form, need not be dwelt upon. Its beautiful pink variety has been long known; another pink variety, of colour more intense, and scarcely to be surpassed in the loveliness of its tint, has lately made its appearance in the nurseries, under the denomination of the new scarlet Thorn. The merit of the double-flowering variety is great, uniting to luxuriance of the individual flower, equal luxuriance in their produce. Several other curious varieties of hawthorn have been collected by the Horticultural Society of London, at Fulham. Cratægus grandiflora is a valuable small tree; and many species of Pyrus, Mespilus, and Cratægus, should find room in an extensive arboretum.

We have nearly concluded our remarks upon ornamental deciduous trees: before we proceed to the Coniferæ, so important in themselves, and so interesting from the additions lately made, and still making, to their number, we shall briefly advert to the mode of transplanting large trees, so well described by Sir Henry Stewart of Allanton in his Planter's Guide, and adverted to in page 45 of this treatise. By careful observance of the precautions laid down by Sir Henry Stewart, trees of very large size may be safely transferred to new spots; but the practice is not new: it has been more or less followed in all ages. The Duc de St. Simon describes what Louis XIV. accomplished in this way at Versailles and Marly. Thirty-three years ago large and successful operations of the same nature were performed by the late Earl of Carnarvon, at his beautiful park at Highclere in Hampshire, principally upon limes, beech, and horse-chestnuts.

We have ourselves removed large trees without failure, and have seen reason to conclude, that notwithstanding the careful preparation of the tree, the preservation of its roots and rootlets, and the careful adaptation of the soil, the success of the effort, and the immediate growth of the tree, will still depend much upon its removal at the beginning of winter, and upon copious watering early in March, to be continued at least every fortnight during the first summer after transplantation, and into the second summer if the leaves shall appear to flag in warm weather.

We observed that the principal want experienced by the ornamental

planter in this climate, is the scarcity of EVERGREEN trees, not being coniferous.

The evergreen or holm oak, is, in point of fact, our only park tree of this description; though of garden shrubs there is no want. The deficiency is partially supplied by the very interesting tribe of coniferous trees. But their forms being generally spiral, they cannot contend, either singly with the bold and varying outline, the extended, tortuous limbs, the swelling masses of tufted foliage, which give to a stately deciduous tree a character of impressive grandeur; or when aggregated over a large surface, in which case, their general monotony of tint, the tameness of their lights and shadows, and the pyramidal termination of the majority of the individuals composing the mass, deprive it of much of the beauty so universally felt in woodland scenery composed of deciduous trees.

One illustrious exception to the first clause of our proposition will at once occur to many of our readers, in the CEDAR OF LEBANON (Pinus Cedrus, p. 127.) In our enumeration, we have said that no tree confers such an air of grandeur and dignity upon the grounds surrounding a mansion, as a full grown cedar of Lebanon, not only the most beautiful of the whole tribe of hardy coniferous trees hitherto known to us, but perhaps altogether the most majestic tree which can be cultivated with perfect success in Great Britain, peculiarly suited to the character of park or garden scenery, and harmonizing better than any other with architectural objects. Thinly scattered in the more elevated vallies of Lebanon, of Taurus, and of other lofty mountain chains and groups in Asia Minor, its somewhat rare occurrence is to be accounted for, probably, by a peculiarity of constitution, which renders a free circulation of air around it quite essential to its vigour. When planted in a wood, or even on a lawn, closely surrounded by other trees, it becomes thin of leaves, feeble in habit, and incapable of swelling to large size. To its full strength and beauty, it is indispensable that no check should be opposed to the horizontal spread of its branches. Even the operation of shortening its lateral shoots, for the purpose of forcing up a leader, cannot be often repeated without injuring its health. These peculiarities render it a scarce tree in a state of nature, where it is only found in elevated, but sheltered vallies, whose vegetation is subdued by the browzing of cattle. It will never abound but in the seats of civilization, and it is exceedingly probable that the parks of England can show more cedars than the whole of the wide range of its native regions. This most interesting and majestic tree is sometimes neglected, in consequence of a groundless apprehension of the slowness of its growth,—an apprehension which we shall proceed, from authentic documents, to dispel. Highclere park, in North Hampshire, the creation of the late and present Earls of Carnarvon, claims a high rank among the most beautiful domains in our southern counties. Some fine cedars of Lebanon adorn the immediate vicinity of the mansion. Their history is interesting. The lawn on which they stand, elevated about 600 feet above the level of the sea, is at the foot of the bold northern escarpment of the Chalk Downs, which rising about 400 feet above the house, extend for twenty miles to the southward. The soil is thin and sterile; the immediate subsoil hard plastic clay, with flints; its substratum chalk, not three feet from the surface. The climate is cold, foggy, windy; the spring very backward, the summer temperature low. We shall proceed to give a tabular view of the progress of the six largest trees, from authentic memoranda, to which we have been allowed access. The two oldest specimens, No. 1 and 2 in the table, were raised from a cone gathered upon Mount Lebanon by Dr. Pococke, the celebrated oriental traveller. The seeds were sown in 1739. Two

only came up, and being planted out, remained stinted plants. They were transplanted to their present sites in 1767, being at that time about 17 inches in girth, at one foot from the ground. The other four trees were raised from a cone brought from Wilton House, the well-known seat of the Earl of Pembroke, in 1772, and were planted out where they now staud in 1778. A very healthy beech, transplanted in 1777, to a spot near these cedars, is of very inferior girth. The following table will afford a view of their progress and present condition.

	1787.	1799.	1812.	1827.	1832.	
No. 1. Cone from Lebanon, raised 1739, measured in 1777, 1. 10½	ft. in. 2 11½	ft. in. 4 11¼	ft. in. 6 10½	ft. in. 8 11	ft. in. 9 3½	3 feet from ground.
No. 2. Cone from Lebanon . .	1 10½	3 11	6 0½	7 10	8 6	Ditto.
No. 3. Cone from Wilton, planted out in 1778, next to No. 2 . .	. .	3 7	6 7½	9 4	10 0	Ditto.
No. 4. Cone from Wilton, opposite north-east angle of house, planted 1778	. .	3 7½	6 6	9 6	10 2½	Ditto.
No. 5. Cone from Wilton, opposite south-east angle of house, planted 1778	. .	. .	6 6½	9 5	10 3	Ditto.
No. 6. Cone from Wilton, in the park, planted 1778	. .	. .	. .	9 6	10 6	Ditto.

A second species of cedar (Pinus Deodara) exists in the Himalayan mountains. It attains to a great size, and in all ages has been regarded with great consideration by the natives of these countries: usually planted by them around the temples of their gods, it would indeed seem, from its name, (devadara or deodara, which means God's tree,) to be, in some measure, dedicated to that especial purpose. It bears some resemblance to the cedar of Lebanon, equals it in size, but, judging from some views of scenery in the Himalaya which we have seen, is, probably, of more aspiring habit. Seedlings have been raised in this country, and its hardihood has been ascertained by a specimen, several feet in height, which thrives in the open ground at Hopetoun House. As it can only be propagated from seed, we recommend this fine tree to the peculiar attention of individuals connected with the country of its growth.

Next in beauty to the cedar, as a park tree, we may, perhaps, reckon the Scotch fir (Pinus sylvestris.) Nothing can well be uglier than a drawn-up grove of Scotch firs. A large, undulating, and sloping wood, consisting of this tree is, on the contrary, an object of striking beauty,—beauty indeed of a peculiar and sombre character, suiting well with heathy forest land of varied surface, and finely adapted to invest with an effect novel, and impressive in this climate, a lake entirely surrounded by such a wood. Some such effect of scenery may be seen around Virginia Water, in Windsor park. The Scotch fir is also fine as a single specimen, when it becomes broad and umbrageous, and tufted; or condensed into small groups composed of a few specimens only. But, upon the whole, we are of opinion that the most appropriate application of coniferous trees, in our climate, is not to intermix them with deciduous trees, but to assemble them into what has been appropriately called a Pinetum. This has been admirably done by Lord Grenville, at his beautiful seat, Dropmore. Such an evergreen quarter is an invaluable winter refuge. The individuals composing it are derived from many countries througbout the northern hemisphere;

they possess a geogrsphical interest; they are of great and diversified value, for suudry economicsl purposes; they differ much in habit, hue, and general appearance. When all other trees are despoiled of their leaves, these, unscathed by the vicissitudes of the seasons, remain unchanged. In deciding upon the site of a Pinetum, attention should be given to the nature of the soil; for though pines, in their native places, grow sometimes in very poor soils,—from the crevice of the naked rock, on the barrenest hill side, or in the most sterile sands; here, where the natives of very different climates are assembled together by human enterprise and ingenuity, to contend with conditions differiug much from those to which nature had originally submitted them, every compensation that is possible should be msde. Shelter is indispensable,—many of the species are delicate,—variety of surface is desirable,—some prefer a less sunny situation than others; depth of soil is essential,—the last degree of vigour should be aimed at; a deep sandy loam is to be preferred, for almost all the species should be carefully guarded from stagnant moisture, and on a cold subsoil few will thrive. To describe in detail every coniferous tree, would be but to repeat what has been already done in this work. We shall pass them in review rapidly, glancing at those which are either new, neglected, or desirable to be added to our vegetable wealth.

Among the species most generally known, the silver fir and the Norway spruce fir are conspicuous. They are both of considerable beauty, pyramidal in form, of great size and bulk, and are sometimes very stately, when standing singly. The silver fir, in England much the largest tree, grows slower than the Norway spruce, during the first twenty years of its age, but then, continuing its growth with accelerated psce, passes it by rapidly. The balm of Gilead fir (Pinus balsamea), nearly allied to the silver fir, perhaps handsomer in foliage, is not worth planting. During the first years of its existence in England, it grows with sufficient quickness, but soon relaxes, becomes diseased, and dies. We are inclined to attribute its premature fate to the average summer temperature in our climate being insufficient to ripen its rootlets sufficiently; for the tree seems to die so soon as, in the natural progress of its growth, its roots have penetrated some depth beneath the surface. The white spruce of North America (Pinus alba) is sufficiently distinguished to merit a place in the pleasure-ground; it differs from the Norway spruce by the peculisr blue hue of its foliage. Pinus uigra and rubra, spruce firs of much humbler growth, are rather subjects for the Pinetum than for the park generally. A most magnificent tree, resembling a silver fir upon a large scale, (Pinus spectabilis,) has lately been introduced from the mountains of the Himalaya. Nothing in the fir tribe can easily surpass in beauty this fine tree, whose silvery bark, bright green leaves, white beneath, and purple cones, studded with drops of transparent resin, render it an object of high attraction. It grows to large size, and, in the south of England at least, is hardy, though, owing to the earliness of its spring growth, it will be liable to receive injury from frost. It is still exceedingly scarce in the nurseries, where it has been increased by cuttings, a mode of propsgstion ill adapted to produce a fine tree. Every exertion should be made to procure its cones; no matter of difficulty now that the British dominion has extended over the remotest recesses of the Himalaya.

We revert to the Norway spruce, so universally known, only to mention the vast mischief done by squirrels in plantations of this valuable tree, and to caution all planters against allowing these animals to multiply. In winter, when pressed by a deficiency of other food,

they bite off the smaller shoots over the whole surface of the tree, finding, apparently, at the gibbous base of the shoot made in the preceding summer, a small portion of pith; at least, we have never seen any but the shoot of one season's growth to be bitten off, and always to have been gnawed only at its base. Being astonished at the wide extent of the ravages committed by these animals, in a large plantation of spruces, scarcely a tree being untouched, we caused the shoots, which had been bitten off and were lying under one tree, to be collected. They filled two corn-sacks. The effect upon the specimen is extremely destructive to its beauty and its growth.

Among the firs long introduced among us is the hemlock spruce fir (Pinus Canadensis) a tree of vast growth in its native regions in North America, and of beauty so striking that we wonder it should still be rare in our gardens. In foliage it resembles the yew, but is of a light and cheerful tint, and is free from that rigidity of habit, which is the general fault of the trees of that section of the genus Pinus, which bear solitary leaves, and are generally called firs in contradistinction to the pines, which bear their leaves in distinct sheaths, enveloping more or less crowded fascicles. A most interesting fir of this section has been recently introduced into this country by the indefatigable collector of the Horticultural Society of London, Mr. David Douglas, from the north-western regions of North America, where it is found abundantly between the rocky mountains and the Pacific ocean. Pinus Douglasii, which is, perhaps, the Pinus taxifolia of Menzies, is a stupenduous tree, growing from 150 to 200 feet in height. One specimen is said, by a traveller upon the Columbia, to have measured 230 feet in height, and fifty feet in circumference. Its timber is singularly close-grained and heavy, its bark surprisingly thick, its foliage very elegant. It is quite hardy, and apparently of rapid growth. Judging from the appearance of young specimens, we deem it the most lovely of its class yet known to us. Reverting to the section, the leaves of which, like the Scottish fir, are borne in sheaths, we must mention another fine hardy tree, brought from the same regions by the same distinguished traveller, Pinus ponderosa, so named from the great specific gravity of its valuable wood. It appears to resemble the Scotch fir in habit, has longer leaves, grows rapidly, but is understood not to arrive at the gigantic stature of Pinus Douglassii. Its wood is singularly close in the grain, and of great durability, probably excelling in value that of any other species of the whole tribe; and as it appears to us to grow as fast in this climate as the Scotch fir, we are inclined to think that it ought everywhere to supersede that species. But as the whole of the individuals among us were probably raised from the cones imported by Mr. Douglas, a fresh importation is a most desirable matter, to which we invite the attention of the public. A tree well known to the Romans (Pinus Laricio) has lately travelled to our collections from the mountains of Corsica. Though its native habitation was so near to us, it had entirely escaped the notice of British collectors, till the overthrow of Napoleon introduced to them a specimen thriving conspicuously in the arboretum of the Jardin des Plantes at Paris. Since then it has been raised in considerable numbers in some of the London nurseries. It is a native not only of the mountains of Corsica, but of the loftier summits of the Grecian archipelago, and has been found upon Mount Ida. Handsomer when young than the Scotch fir, it is equally hardy, has longer and finer foliage, is of more elegant habit, produces timber of greater specific gravity, and is very deserving of the marked attention, not only of the ornamental planter, but also of the planter for

profit. Another very interesting tree from the East, introduced into the country about twenty years ago,—Pinus Pallasiana,—has been better known by the name of Pinus Taurica. In the central regions of the Crimea, on the western declivities of the mountains, which stretch along the shores of the Black Sea, this tree, called *tzaam* by the natives, forms considerable forests, and grows to a great size. Its wood is very knotty, resinous and durable, but is not well adapted to the purposes of the joiner, on account of the knottiness of its texture. It throws out its branches, almost from the base of its trunk, in a horizontal direction, and is said to be strikingly picturesque in its habit. It abounds with a resin singularly odorous, and will probably be one of the most distinguished inhabitants of the Pinetum. But the experience of Mr. Lambert has assigned to this tree a station of singular utility. He has ascertained practically its capacity of flourishing upon the most barren chalk downs, where the thinness and aridity of the soil combine to forbid almost every other tree from succeeding. A few trees which he planted at Boyton about twenty years ago, where the soil was little more than two inches thick upon a bed of hard chalk, are now nearly thirty feet high, and very luxuriant. Many were planted by the present Duke of Marlborough at White Knights. Their cones produced in this country have never perfected seeds, but it cannot be difficult to procure them from the Western Coast of the Crimea. It may be as well to remark here, that in bringing home cones of any fir, peculiar care should be had in placing the box containing them, in an airy situation, in the cabin or between the decks. The high temperature and confined air of the bold of the ship destroy the life of seeds speedily. A very magnificent pine was discovered by Mr. David Douglas in sandy plains in Northern California, and appropriately named Pinus Lambertiana, in honour of the very distinguished botanist, Aylmer Bourke Lambert, Esq., whose magnificent work on the Genus Pinus, to which we have been largely indebted, has contributed in a remarkable degree to elucidate the history of this extensive genus. It is a plant of vast size, growing in its native plains from 150 to 200 feet high: one specimen which Mr. Douglas measured was 215 feet in length, and 19 feet in diameter. The cones of this splendid tree are sixteen inches in length and nine inches in circumference. We apprehend, from some observations which we have made, that in Great Britain it can only be regarded as a specimen tree, confined to very sheltered and warm spots. But the recent and still-pending researches of the same enterprising traveller and enthusiastic botanist, in the same regions of North America, the regions which bound the Northern Pacific Ocean, bid fair to enrich the Pinetum in no common degree. In the mountain valleys of the Alps of New Albion, surrounded by snow peaks exceeding Mont Blanc in elevation, he has lately discovered several most interesting species, which must all be hardy in England:—Pinus nobilis, and Pinus grandis, equalling Pinus Lambertiana and Pinus Douglasii in hugeness of stature; Pinus monticola, two varieties, resembling in elegance of foliage the Weymouth pine; Pinus Menziesii, of smaller growth, but curious habit; Pinus Sabiniana,—are all plants of great interest, and will be acquisitions of uncommon value. We suspect that mountain trees, from elevations correspondent in temperature with the climate of Britain, will be found to succeed in it better than trees from lower regions, even when situated more northerly. The larch of Switzerland and the Tyrol countries, to the south of us, succeed better here than the larches of Siberia and Canada. The Pinus Laricio of the mountains of the genial countries of the Mediterranean is more at home in England than the

Pinus balsamea of Nova Scotia; and it may be expected that the trees of North Western America will do better with us than the trees of correspondent latitudes in the United States, where the extremes of summer and winter temperature are more violent than in the countries bordering on the Northern Pacific Ocean.

In treating of garden trees, we have omitted to mention Pinus cembra. Even in its native climate and soil, among the mountains of Switzerland, it is remarkable for the slowness of its growth, and in England the Swiss variety preserves the same character; but it is also indigenous to Siberia; and we have observed that the Siberian variety, which is not uncommon in our nurseries, makes less rapid progress than its Swiss congener. Pinus cembra, when it has attained to considerable size, is one of the most ornamental trees of the whole tribe, and should find a place upon every extensive lawn.

It would be superfluous here to discourse upon trees so well known as the larch, whose wood almost rivals the oak in durability, and whose bark is about half the value of the bark of that tree; of the Weymouth pine, whose stem furnishes masts; of the Stone Pine, whose vast canopy, supported upon a naked column of great height, forms one of the chief and peculiar beauties in Italian scenery, and in the living landscapes of Claude; of the pinaster, whose clustering cones and fine foliage entitle it to rank high among the most picturesque of its congeners; of the Mugho pine, and Pinus pumilio, whose low dwarfish growth are of great value in the picturesque arrangement of a Pinetum. There are several other species, which, though neither of size nor of beauty to entitle them, in this brief sketch, to a distinct notice, should be included in the range of a well-ordered collection. We shall, however, pause a moment to advert to Pinus excelsa and Pinus Gerardiana, both lately introduced from the regions of the Himalaya. The former is a tree of large size, growing from 90 to 120 feet high; the latter a fine tree, said to resemble the Stone Pine, and known to the natives by the name of the Neoza pine, produces an abundance of edible seeds. Several other species exist upon the Cordillera of the Andes, stretching from the northern side of the equator, through Mexico to New Albion, and at intervals rising into the region of eternal snow; some perhaps upon the mountain chains of Caucasus and of Central Asia. A few coniferous trees of other genera remained to be mentioned. A noble tree of most exotic appearance (Auraucaria imbricata) graces the more southerly plains of South America, and with slight protection endures the climate of the south of England. Another species of too tender constitution (Auraucaria Brasiliensis) is supplied by Brazil; others exist upon the shores of Australia: the noblest of all, and the fairest (Auraucaria excelsa), whose beauty and stateliness are faintly represented by a few specimens confined within the narrow limits of our conservatories, is found, exclusively we believe, in Norfolk Island, one of the loveliest spots in the southern hemisphere, (the penal station of the penal colony of New South Wales), where it rises to the magnificent height of more than 200 feet, and reaches to bulk correspondent with so vast a height. A very pretty tree, nearly allied to Auraucaria,—Cunninghamia lanceolata, —is becoming general in collections. It is a native of China, and hardy in light soils. Being always in this country propagated from cuttings, it requires some management to make it throw up a vigorous leader, and assume the habit of a tree. If, however, it be planted out in a sheltered situation, and in good soil, and if then, when it shall have made a considerable mass of roots and is well established, its shoots be depressed into a horizontal position, and so confined with pegs, it will ultimately

throw up a strong perpendicular shoot from its roots, and make quick progress. Sometimes these strong shoots, after a year or two of rapid growth, relax their speed, and discontinue the function of a leader: in such cases they must be depressed as before, and the practice will be sure to succeed at last.

The Italian cypress (Cupressus sempervirens), so conspicuous and so beautifully applied in the terraced scenery of Italian villas, cannot be said to attain to full vigour even in the south of England. It is essentially the tree of architectural gardens, and ought never to be forgotten when the climate and soil admit of its application. A tree nearly allied to it, but deciduous (Cupressus disticha of our enumeration), now separated into a distinct genus, under the name of Taxodium distichum, is one of the largest and most ornamental of all the trees which thrive in temperate climates. Nothing can well surpass the loveliness of its light and delicately-coloured foliage. Though a native of Mexico, and of the southern sections of the United States, inhabiting the deepest deposits in the valleys of their vast rivers, and luxuriating in the deadly swamps of the Mississippi, yet in England it appears to be perfectly hardy,—affording one of many instances, that trees vary in hardihood of constitution, and are not to be absolutely tested by the latitudes, or even by the elevations, where nature has originally placed them. It should have a deep, and, if possible, humid soil. When we say that no pleasure-ground should be without it, we but faintly express our sense of its elegance. Another species of taxodium (Taxodium sempervirens), an evergreen tree, exists on the North-Western shores of America, and should be introduced into this country. One, if not two, true species of cypress are known to be found on the same shores. In China and Japan several species of conifera are among the most remarkable characteristics of their vegetation. Cupressus pendula, which equals the weeping willow in the charms of its pendant branches, in China is generally planted to hang over the tombs of the departed. Nothing can be better in unison with this purpose than the dark and weeping branches of this tree. Several species of thuya, inhabitants of the same countries, are great desiderata. Among them, Thuya dolabrata calls upon us for the most earnest endeavours to introduce it. This plant is described by Kæmpfer and Thunberg, who saw it in its native soil, as a lofty, vast, and beautiful tree, of all evergreens the fairest. It is unquestionably hardy. The policy of these remarkable nations opposes the most inflexible resistance to European intercourse. Still the perseverance of individuals, and of the Horticultural Society of London, have procured us many of their beautiful plants. The camellia is the chief spring ornament of our conservatories; their magnolias, their azaleas, their pæonies, decorate our pleasure-grounds; the corchorus and the numerous varieties of the china rose, adorn our humblest cottages; but scarcely a forest-tree has yet taken its station upon our lawns. We cannot doubt that this may also be achieved. To China, to Japan, to the Himalaya, and other mountain chains of Central Asia,—to the alpine vallies of North-Western America,—to Patagonia, the hills of Southern Chili, and the archipelago of Chiloe,—we look as to the sources almost unexplored of additional wealth to the arboretum. Our intercourse with almost every corner of the habitable globe is so intimate, communications with the most distant nations are so frequent, so many accomplished individuals inhabit countries the most remote, that we are persuaded it is only necessary to invite general attention to our favourite object, in order to place it in a fair train for accomplishment.

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THE END.

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A

PRACTICAL TREATISE

ON THE

BEST MODE OF REPAIRING ROADS,

WITH

SOME OBSERVATIONS UPON THE PRESENT SYSTEM.

By CHARLES PENFOLD, Surveyor,
CROHAM, CROYDON.

B

A PRACTICAL TREATISE ON ROADS.

The art of road-making is of daily increasing importance, and as the attention of the public is directed to the subject so will its utility be appreciated. Few years have elapsed since it was considered below the notice of persons of science and education; and had not the exertions of some eminent men, such as Telford and M'Adam, excited the general attention of the country, and shown how much benefit might be obtained by a judicious application of labour, our roads might have remained in the same imperfect state which they exhibited before that period.

The improvement, however, is only partial, and chiefly on the turnpike-roads; while the generality of those under parochial management continue in a defective state, although a much greater amount of money and labour is annually bestowed upon them, than would be sufficient to maintain them in complete condition. Want of knowledge occasions a useless expenditure. Materials are selected without discrimination; they are not broken to an uniform size; they are carted, at vast expense, to places already supplied to excess; no attention is paid to drainage; and labourers are paid by the day, instead of by the piece.

The object of this essay is to show how good roads may be obtained at a less expense to the country than is now incurred in keeping up the rough, rutty, and misshapen ones. In effecting this desirable end, the able-bodied labourers who have hitherto sought for employment, and sought in vain, would find a market for their labour, and the poor's-rate, consequently, be greatly relieved. Money has hitherto been thrown away in the purchase of unnecessary materials and horse-work, when *manual labour* only was required; and the expenditure would be turned into a direction, under the new system of repair, which would not only relieve the poor's-rate, but *reclaim men from pauperism*. When a man is employed by the surveyor he is no longer a pauper, he is at once independent, and giving value for what he receives. Under the present laws relating to parish roads, and by which parish surveyors are appointed, instead of the repairs tending to find independent employment for the able-bodied, the amount of pauperism has been increased. Instead of the parish surveyor employing labourers himself in digging his materials, and treating them as men giving value for the money they receive, the overseers have been the parties to employ them, and have made them paupers. Every load of gravel dug upon this system cost ten times as much as men would have dug it for employed by the surveyor, and paid by the *piece*. Nothing can be gained by assembling a large body of paupers in a gravel-pit, to countenance one another in their endeavour to do as little work as possible, and to concert schemes for riot and debauchery. It is far better for the surveyor to employ them as independent workmen, and give them a fair value for their labour, and to pay them only for what they do, under the proper system of piece-work.

It is distressing to any one to reflect upon this subject, who is well acquainted with all its bearings, and to see the same system continued year after year, when an alteration might be made which would remedy the evil. A more beneficial mode of employing the able-bodied labourers

of this country cannot be pointed out than the maintenance of the highways; which would at the same time be advantageous to the country in general, and promote the independence and comfort of the labourers themselves.

That part of the present system which is called Statute Duty is one of the evils that militate against the possibility of keeping the parish highways in repair, well and sufficiently, at the least cost. It had its origin in days long gone by, when all persons, with their horses and carriages, were commanded by the King to lend their aid in making the highways passable for his Majesty's troops. It was afterwards made a compulsory duty, and the proportions to be done by each person were settled by Parliament, and therefore called Statute Duty. This mode of levying contributions towards the repair of the highways is highly objectionable, and should give place to an improved principle, which will be just to all parties. The system of statute duty is this: when a rate is made for the purposes of the highways, every person keeping a team, or renting 50*l.* per annum, is liable to do as many days' work as may be required by the surveyor, not exceeding six. If he do not keep horses, he must pay money in lieu of work. He must pay the amount which is fixed upon by the magistrates at Michaelmas. For example, if the price fixed be 15*s.* per day for a team, he must pay that amount as many times told as the surveyor requires days' work, and again for any additional team or 50*l.* rental; so that if a person do not happen to keep horses, he must pay in money the full amount of the work which he should do. Now, see the injustice of the system of statute duty: the work being executed by the day, and not by the piece, instead of the 15*s.* worth being done by those who keep horses, it will be found, as it always has been found, that not more than 7*s.* worth of work is done; so that the one party pays 15*s.*, when the other only contributes 7*s.* This arises from the statute duty being day work, and it has such a tendency to injustice, that it ought to be done away. The principle also upon which it is calculated is so confusedly arranged and expressed, as to render it almost unintelligible to the generality of surveyors. It may be said, indeed, that but in very few instances is the act of parliament in this respect complied with. The practice under the present law of choosing men entirely ignorant of the art of road-making, and whose interest is adverse to a proper execution of the law, at once shows how little skill is considered necessary for the purpose. There surely are not any instances in this country where a tailor is employed as a sculptor, or a shoemaker as a watchmaker; yet such persons are often appointed as surveyors of the highways, and so long as the present law continues will these absurdities take place. What is the consequence? From want of knowledge of his subject, the surveyor so appointed considers that if a road be full of holes, he has nothing to do but to fill them up; the larger the stone the stronger he thinks it: and the holes are therefore filled with large materials, sufficient, indeed, to shatter a wheel that is slightly made. He has no idea that there are at present in the road huge stones enough, if picked up and broken, to last for years to come, his only notion being that the holes are caused from want of more materials; and thus he spends his resources in *horse*, instead of *manual labour*. Those horses would be much better employed in giving an extra ploughing to the farmers' fields; and the poor labourer would be much better employed in picking the road up, than in standing at the door of the overseer for money which he has not earned.

But the whole management of parish roads, with few exceptions, is of a piece with this. It is not necessary to enter into every particular in

which it is evidently defective. Reference to the state of the roads themselves, and the amount laid out upon them, will quite fill up the omission. There is no reason at all why every mile of road in this country should not be made good—not the turnpike-roads only, but every mile of public road. The money that has been given to the able-bodied in the shape of relief, and for which little or nothing has been returned, would have effected this long since; but the present law stood in the way of so desirable a result, and the poor have consequently been looking on in idleness, and become demoralized. The moving power was wanting, not the machinery. Had the law been such as to secure the *management* necessary, the effect would have been produced.

The writer is much pleased to find that his notions upon the subject agree with those of so high an authority as Sir Henry Parnell. The following are his observations on parish roads:—" The roads commonly called parish roads in England are generally in an imperfect condition; this is owing chiefly to the law by which the management of these roads is placed under the governing authority of the vestries of the parishes through which they pass. Blackstone says, ' In England every parish is bound of common right to keep the roads that go through it in good and sufficient repair, unless by tenure of lands or otherwise the care is conveyed to some particular person.' The principle here established, of placing the common roads of the kingdom, not being turnpike roads, under as many separate governing authorities as there are parishes, is in every respect repugnant to anything like a sound principle of management, and until it be abandoned no efforts of legislation can prove successful in introducing any real improvement. So long as this radical error shall be acknowledged by Parliament, it will be labour in vain to pass acts of parliament containing a multitude of new regulations. The influence of the original cause of the evils which prevail, will render them, as they have rendered hundreds of similar regulations, wholly abortive. Legislation on the highways of England, to be of practical good, must be founded upon a more enlarged view of the subject, and instead of the governing authority of a parish, it seems advisable that that of a county should be substituted; or when counties are very large, that of a division of a county.

" The reasons which may be given to support this general proposition are so obvious, it is unnecessary to state them all in detail, two only will be noticed. The first is, the private interests of a vestry lead it to be satisfied with very imperfect roads. A road that will allow a waggon to be drawn upon it without much difficulty will answer the purpose of those who compose the vestry. But such a road need not have any other qualities than two ruts for the waggon wheels, and a trackway for the horses. The second reason is, that the limited extent of the funds of a parish will not admit of giving such a salary to a surveyor as will secure the services of a person educated in the principles of road management, and otherwise qualified for the office of surveyor.

" The next great error in principle as to legislation on the common highways is, the means by which the funds for maintaining them are provided; namely, statute labour; and it may be said upon this point, as it has already been said on the former, that so long as this radical error in principle shall be recognised by Parliament, it will be labour in vain to pass new acts to remedy existing evils.

" A third great error in the system of parish management consists in the regulation by which a surveyor is appointed to act for only one year. This practice is founded on the vulgar notion, that the management of roads is something that requires no education—that it is not an art which requires

skill and science. This practice may be set down as one which had its origin in very rude times, and which long usage has made familiar, but it certainly is one which ought to be abolished in the present enlightened state of society. To legislate, therefore, on sound principles, the old custom of seeking to mend what is wrong by laws containing a multitude of new regulations, must be abandoned. The country gentlemen, who, as members of Parliament, undertake the task of legislating on the subject, must look more to general principles; and to succeed they should no longer act upon the principle of making parish vestries the governing authority, the principle of acquiring funds for the maintaining the highways from statute labour, and the principle of appointing annual surveyors."—Page 309.

It will be as well here to point out in what way the amount raised for the repair of parish roads is disbursed, and how it would be applied under the new system. According to the returns made to Parliament in 1814, and alluded to in the Report of the Select Committee of the House of Commons on County-rates and Highways last year, the sum of 1,500,000*l.* was raised for this purpose. Now, Sir James M'Adam, in his evidence before that Committee states, that the average expenditure in the two items of horse and manual labour, for the two years previous to his undertaking the Epsom roads, was, *horse labour*, 1044*l.*; *manual labour*, 359*l.*; and that under his management the proportions for those two items varied as follows, viz.: *horse work*, 227*l.*; *manual labour*, 1146*l.* The million and a half expended upon the parish roads may be divided into the following items, viz.:

Materials, tradesmen, and officers	£500,000
Manual labour . .	250,000
Cartage . .	750,000
	£1,500,000

Giving the same proportions to the two items of labour as Sir J. M'Adam found to be in practice on the roads alluded to, and which are the proportions generally throughout the country.

Under the new system the items for horse and manual labour, upon the authority of the evidence before quoted, would be thus varied, viz.:

Manual labour . .	£833,000
Cartage . .	167,000

The excess of manual labour to be employed under a good system of management then would be 583,000*l.*, supposing the same amount to be expended as heretofore, which would be the case until the roads were brought into a good state of repair. But so great an outlay, it is contended, after a year or two, would not take place, and the assertion is grounded not only upon reason, but experience and trial.

The reason will be found upon the perusal of the following essay, which it is hoped plainly points out why a saving *must* take place under an efficient management; and the inefficient management of the present system is evident from its ill effects, and from its being the reverse of that which is adopted where expenditure is saved.

The writer has had the care of parish and turnpike roads for years, and by following the principles laid down in this work, he has effected a saving in expenditure to the following amounts:—Upon the parish roads of Croydon, from 1047*l.* 16*s.* 5*d.*, which was the average annual outlay of four years, to 485*l.*, which was the average annual outlay of the succeeding four years. Again: upon the portion of the Surrey and Sussex roads lying between Croydon turnpike-gate and the bridge at the entrance to Streatham parish, the Trust assigned 1000*l.* a year as the amount to be expended

upon that portion of their roads; and lately, upon an estimate made by an eminent road surveyor, with the view of apportioning the sums to be expended on the various lines of that Trust, he assigned 830*l.* as a fair amount of outlay to be made on that line. The writer, however, has kept it in repair for the sum of 554*l.* 6*s.* 3*d.* upon the average for the last three years*, and since that estimate was made. Knowing, therefore, that proper management will assuredly effect a saving in the amount to be expended, it may fairly be said, that out of the million and and a half hitherto laid out under the old system, 500,000*l.* may be calculated upon as the sum which the country would be relieved of in the actual amount to be collected under the head of highway rate, after the roads are brought into a good state of repair.

During the time of converting the roads from their present state into the state in which they ought to be, the expenditure will continue the same in amount, but the items of it must be varied as before shown, viz., instead of 250,000*l.* only being expended in manual labour, and 750,000*l.* in horse work; 833,000*l.* would be expended in *manual* labour, and 167,000*l.* in *horse* work. The difference, then, between 833,000*l.* and 250,000*l.* will be saved in the poor's-rate, *i. e.* 583,000*l.*

The sum of 500,000*l.* of the old expenditure, which has been set down for *materials, tradesmen, and officers*, it is calculated, would remain the same for the first year or two, whilst the roads are being brought into a proper state, but varying the items of which it is composed, *i. e*, although the amount expended for *materials* will be very considerably less, the outlay for tradesmen's bills and management will be greater; but taking them together the total would be the same. After the roads are reclaimed from their old bad state of repair, it has been shown that the outlay will be reduced from 1,500,000*l.* to 1,000,000*l.* It is necessary, then, to show in what way the money will be disbursed, because after the roads are once made good, the items of expenditure change materially. As it is the writer's desire to come at the truth, and not to put a false colouring upon the statement, it is proposed to enter into the detail of the outlay in every point of view.

In the first operation of reclaiming the roads, but few materials and but little horse work are required, the expense consisting chiefly in *manual* labour and tradesmen's bills. When once this desirable object is accomplished, although the total cost is less in the proportion named, the items vary, and would be found, from experience, to be in the following proportions, viz.:

The manual labour would be .	£402,000
Horse labour . .	228,000
Materials, tradesmen, and management	370,000
	£1,000,000

We then have a saving in the highway rate to the amount of 500,000*l.*, and although the saving would not be so great in the poor's-rate, *after the roads are in a good state of repair*, because so much manual labour will not be required; yet even then there would be an excess of labour employed to the extent of 152,000*l.* This sum, then, will be saved in the poor's-rate constantly, and half a million in the highway rate, with the roads in repair equal to the turnpikes, and all the cost of management defrayed. Whether this be a fair deduction from the premises, the reader will judge; but that the additional quantity of employment above stated

* A reduction to this amount, it is confidently felt, can be effected in most of the roads in the kingdom, where the principles herein described have not been followed.

will be found there can be no doubt. It is not probable, then, that the people would long object to an alteration in the law, when their interest is so much concerned in it. It is one of those alterations, however, which must be provided for and defined by the Legislature.

It cannot be accomplished if left to the option of parishes. It must be effected by *consolidation*, by *districts being formed*, by *Boards of Management*, and *able officers*. By, in fact, composing a new highway system upon an enlarged view of the subject.

The principles which should be followed in the repair of public roads will now be described.

This essay treats more of road repairing than of road making *de novo*. The desire is to lay down rules by which the *parish roads* of this kingdom may be reconstructed.

Although the same principles will apply to turnpike roads, yet these cannot be said to be so entirely mismanaged as the other description of roads. In the one case, there are trustees acting constantly to control and direct the affairs of the turnpikes, and chosen officers continued year after year. But in the other case, the surveyor is unpractised, and altogether unfit for the office; with no one to guide and assist him during the continuance of his year of service.

PRINCIPLES TO BE FOLLOWED IN REPAIRING OLD ROADS.

FOUNDATION.

Attention must first be drawn to the foundation of the road. Men, eminent for their skill and practical knowledge, differ upon this point; the one party contending that a *pitched* foundation is necessary to make a substantial and good road; the other, that no pitching* is essential. The one says, that you cannot make it *non-elastic* without the pitching; the other, that the pitching is so much expense needlessly incurred.

It would seem that the latter is the most reasonable conclusion. The pitching is either unnecessary, or mischievous, when the body of the road is to be constructed of a *softer or more brittle material*. For if a more brittle material be laid upon one of a stubborn nature, and where there is not thickness enough of the inferior sort of itself, or of its own weight, to support the loads it is subject to, that material, lying between two hard substances, must be pulverized. The heavy waggon-wheel above, and the hard pitching-stone beneath, place the flint or gravel in a situation similar to the wheat between the miller's grinding-stones. If, however, there be a thickness of materials upon the road sufficient to preserve them from this effect, the weight of the flints themselves will form power enough to compose the road, without the solid assistance of the pitching-stones. The plan of a pitched foundation could only have been resorted to where the funds so abounded as to allow of such an extravagant proceeding.

It perhaps may be conceded, that upon a road which is liable to great and heavy traffic, and where there are ample funds at hand to supply the expense, and in order to render security doubly sure, the practice may be resorted to. But then it must be qualified by an undertaking that as great a thickness of broken metal be always kept up upon this pitching as to secure the upper substance from being sacrificed.

The best foundation for a road is a substratum kept perfectly dry by

* Pitching is a foundation formed of large stones.

proper and effectual drainage. Secure this, and it forms a basis for the materials to rest upon, far more economical, in every respect, than the pitching stones; first, in the prime cost of it, and, secondly, in the diminution of wear. As to the elasticity, or *giving* propensity in a road, made without pitching stones, nothing need be apprehended; for with a subsoil drained, and a competent thickness of the common materials kept up, elasticity vanishes.

Besides, in a pitched foundation some of the stones would be liable to sink deeper into the subsoil than the rest, and would consequently cause holes to appear in the surface, which would not occur when a body of flint broken small is the substratum.

If one substance used in road-making be harder than another, that substance should be upon the surface, and not at the foundation; to lay the softer upon the harder, must have the effect of sacrificing the inferior material. If the pitching-stone be of a softer nature than the materials to be laid upon it, the objection to its use will not then apply.

DRAINAGE.

Next in order comes drainage. No attempt at repair must be made until great care has been bestowed upon this point—a point so desirable in road-making, that any exertion in other respects will be fruitless when this is unattended to. Of what service can metal be when the road is immersed in water? Can it consolidate? Can it form a compact and hard substance when water is amongst it, consuming as it were its very vitals? Water in a road is as the canker, inwardly fretting and destroying the very principle of life. Assistance then must be given by the hand of skill—the intrusive, unwelcome visiter must be shown the door. To effect this, let the ditches be examined, and if found not to be sufficiently below the foundation of the road, they must be cleansed and lowered, and a ready fall secured leading from the road. If the fall be slight, create if possible an artificial one. If the subsoil of the road contain springs, find them out, and fear not to cut well into them, laying an under-drain of tiles or blocks of chalk, or large pieces of stone or bricks, from the point of the spring into the ditch. If this be not done, the road in those places will be constantly sinking into holes and soft places, and consume more materials in a year than the expense of the under-drain will amount to; but the under-drain will last for years, and the roads be always sound. Outlets from the watertables into the ditches cannot be seen in too many places: if they be not attended to, the water which falls upon the surface of the road cannot escape, and must have a bad effect. It will very often be seen, that the lands adjoining are situate upon a higher level than the road, and when this is found, water will have a natural tentency to pass through and across it.

In these instances, if there be no ditch to intercept the water, there must be one made, or an under-drain along the watertable, or under the footpath, formed, as before described, of chalk or stone, that the foundation may be preserved. When a particular piece of road is observed to be continually heavy and in a bad state, requiring a coat of materials constantly repeated, it is situated either in that manner, or in a flat, where the water cannot escape. There are very few instances in which relief may not be afforded by drainage; and a careful observer will find how immediate the relief is, and how much wear is saved when effectually conducted, and how improved the road becomes with respect to the draught for horses. It will be found that drainage is less attended to upon parish highways, than even the general course of repair by gravelling, &c.

It is not necessary to say more upon this part of the subject than to repeat, that before any other step be taken towards repairing a road, the drainage must be made perfect, or all efforts, in other respects, will be labour in vain.

THE SUBSTANCE OR THICKNESS OF MATERIALS.

Without a sufficient depth of consolidated materials there will not be a resistance equal to the weights which a highway is subject to. There must be weight to resist weight. This may be regulated by the degree of consolidation which the body of the road has, by skill, acquired. If the weight of metal forming the substance be of an imperfect quality, more will be required than when sound and clean. In proportion to the quantity of deleterious matter contained in the body must the thickness be increased. Any matter that is not of a sound nature has no power in road-making, and, therefore, the hard materials alone contained in the road's substance can be calculated upon as possessing the quality to resist weights.

If an inefficient thickness of good materials be allowed to continue for any time, the result must be a heavy and imperfect state of road. The power will not be equal to carry the weights, and the condition of the surface will be worse and worse, until the whole body will be cut through, ploughed up as it were, and become impassable. It will be beyond the skill of any one to keep a sound road, when the strength is unequal to resist the passing pressure. Experience has taught, that there can be no real security against a road giving way, taking the year through, unless twelve inches at least of good sound consolidated materials form the body of a road; and this upon a foundation rendered sound and dry by effectual drainage. In many instances, there may be less substance than this, and the surface may appear perfectly sound and level to the eye; but in the event of a severe winter such a state of things will speak for itself. It will make itself manifest by the *blowing up* of the road at the giving of a long frost; when parsimony will prove itself to be but foolishness. Provide, then, the degree of substance before mentioned, and rest satisfied that enough has been done in this particular.

SORT OF MATERIALS TO BE USED.

It is obvious that a surveyor in the choice of the materials with which he would construct or repair a road must be mainly guided by the expense at which he can procure such materials broken and thrown down in the situation in which they are to be used. The ability to ascertain the strength and durability of each sort of stone, so as to form a correct estimate of their comparative value, is one of the chief qualifications of a road surveyor. It is a ruinous economy often practised to use soft stone, because it may be obtained near at hand, and at a third of the price of a strong stone which may be brought from a somewhat greater distance; and sometimes from an ignorance of the qualities required in a road-stone, inferior materials (as flint) are preferred, when superior materials (as whinstone or basalt) may be obtained at equal, or even less cost. We shall now offer some rules for the guidance of road-improvers on this head, laying down first the principle on which the selection ought to be made, and afterwards illustrating it by reference to particular kinds of stone*.

"There is (says Sir John Herschel, in his Discourse on the Study of Natural Philosophy, par. 257.) a certain degree of confusion prevalent in ordinary language about the hardness, elasticity, and other similar qualities of solids, which it may be well to remove. *Hardness* is that disposition of a

* The Author is indebted to a friend for much of this section.

solid which renders it difficult to displace its parts among themselves. Thus, steel is harder than iron, and diamond almost infinitely harder than any other substance in nature. The *toughness* of a solid, or that quality by which it will endure heavy blows without breaking, is again distinct from hardness, though often confounded with it. It consists in a certain yielding of parts with a powerful general cohesion, and is compatible with various degrees of elasticity." The confusion of which Sir J. Herschel here speaks, between *hardness* and *toughness*, has led to serious practical errors in the choice of materials for roads, inasmuch as the attention has been often directed exclusively to their hardness, without any regard being had of their toughness. If roads were only exposed to the friction, or to what is usually called the *grinding* of the bodies moving along them, the quality of hardness would be sufficient; but as the surface of the road also supports their weight, and is subjected to their *pounding* or *crushing* action, it is necessary also to take the toughness of materials into the account. The latter quality is in fact far more important than the former, inasmuch as the pressure of heavy weights affects the entire substance of the roads, dislocates the stones, produces inequalities of level, and entirely destroys some portions of the material; while the wear of the wheels merely affects the surface and grinds the face of each stone by a slow and regular process. The importance of toughness in a road-material may be illustrated by supposing a road to be formed of pieces of glass, a very *hard*, but extremely *brittle* substance; it is manifest, that under the pressure of heavy weights such a road would be crushed to powder in a few hours. A mistake, similar in kind, though less in degree, has been committed by those who have thought that flint is a good road material, because it is *hard*, the fact being, that is not a good road material, because it is *brittle*. Another quality desirable in a road-stone is, that it be as far as possible homogeneous, or of a similar texture throughout; as, if one of the component parts is weak, the stone will crush, although the other component parts may be strong. Granite is an instance of this, as its felspar, especially if well crystallized, is easily pulverized, although the hornblende is hard and tough. The superiority of tough stones which do not readily crumble under pressure is manifest; not only do they form sound and even roads, with little mud in wet weather, and with little dust in dry weather, but (as Mr. DelaBeche * has properly remarked) on account of their durability, they lessen "the amount of hinderance caused by the more frequent supply of rough new stones, which tend so much to retard the progress of wheel carriages, and add to the labour of the horses that draw them."

For ordinary purposes, Mr. DelaBeche suggests that the best means of ascertaining the comparative toughness of stones is to pound equal pieces of equal size. In general those stones which are most easily broken into small pieces with a hammer are those which are least fitted for roads.

The mineralogical character of rocks comprehended under one geological denomination often differs so widely, that it is difficult to lay down any rules which shall be universally true of any kind of stone. The following remarks will, however, be found of tolerably general application.

The trappean and basaltic rocks are those best suited for the construction of roads. No material has ever been used superior to the tough basalts, which are brought in ballast in ships from China and Bombay, and which have been partially used in the Macadamised streets of London. The whinstones of Northumberland, and the dark basalt of the Clee Hill in Shropshire, are almost perfect as road-stones. Among the granites, the Aberdeen, the Guernsey, and Dartmoor are preferable to that of Corn-

* How to observe, p. 300.

wall. Indeed the darkest in colour are invariably the best, as containing a greater proportion of hornblende, which is tough, than is found in those of lighter colour, where the brittle substances of felspar and quartz are the chief ingredients. Limestones in many respects afford an excellent material; but, excepting the carboniferous and some of the transition limestones, against which little objection can be urged, they have several defects which partly counterbalance their merits of smoothness of surface; they are too tender for the *support* of heavy weights, and are so slippery after wet as to cause frequent and unavoidable accidents.

It will be hereafter remarked, that the more unyielding the material, the smaller is the size to which it ought to be broken; while soft stones may be safely laid on a road in larger pieces. Limestones, however, have in general a peculiar quality of making smooth roads, even if not broken to a small size, probably on account of the binding and cementing power which they possess. Pit gravel, especially that belonging to the new red sandstone formation, is in general not to be depended upon, as containing stones of different sorts, and consequently of different degrees of strength. The gravel of the chalks and other soils in the southern part of England consists, however, almost entirely of flint; which, as has been above remarked, is too brittle to form a good road-stone. In places, however, too remote from water-carriage to admit of any substitute being obtained at a reasonable expense, the following rules for the use of flint pebbles may be observed:—

In the first place cleanse them of all dirt and useless matter by sifting. Then separate all the large from the small stones by a like operation; but through a coarse sieve having the wires an inch asunder from centre to centre. Break every stone that will not pass the sieve, so as to reduce it into angular pieces. Lay on the unbroken pebbles first, but by no means in large quantities. Upon them put a moderate quantity of chalk, if it can be obtained, equal to about a fifth part of the quantity of pebbles laid on. When the pebbles and chalk have worked together awhile, spread the angular pieces over the whole. Too great space of time must not be allowed to elapse before the broken pebble be laid on, or the surface will, perhaps, have become too hard to admit it, and an unnecessary waste will occur before incorporation takes place. Some of the hardest surfaces have been made in this way, with chalk and pebbles, and they answer well for the summer season and open weather; but in frost *blowing up* must be expected in proportion to the quantity of chalk used, and the coldness of the weather. This will not happen every winter; and when it does occur, does not last for any length of time. Of two evils, however, the least must be chosen. It is more desirable to have a sound hard surface for fifty weeks in the year, and two weeks of bad, than to have a loose pebbly road during the whole year.

When the road is *blown up*, the only thing that can be done, whilst it continues, is to keep it raked level; and when the frost is gone, to re-form it by lifting. It is probable that although the blowing up has caused temporary inconvenience, it will end in a still sounder road being produced, if properly managed.

PREPARATION OF MATERIALS.

Great negligence or want of skill is shown upon parish roads, in the preparation of materials before laid on the road. There are, at any rate, but very few exceptions to this assertion, and they are only to be found in those cases where enlightened gentlemen, from the interest they feel in the ubject, undertake the office of parish surveyor.

In general it will be seen, that materials are brought to the road in large

quantities, and of a great size, full of dirt, clay, and other pernicious matter. They are not broken, but large and small, round and angular, in one promiscuous mass, are shot down upon the surface. It sometimes happens that a surveyor, rather more nice in his operations than the rest, will break a few of the largest size, but no farther: the mass of mixed substances is left to form itself into a road, as chance may place it or as it may be urged or worked into a settlement by the action of passing wheels. Much of these ingredients is of a nature to be very injurious to a road, and cause it to be in a heavy and dirty state, forming a great impediment to the traveller. See also what has been done by such a practice! Expense has been incurred in the purchase of this trash, in the carting (perhaps for miles), spreading, &c., and when it is on the road, instead of causing any improvement, it has rendered the condition of the surface worse than it was before. The evil does not end here, as additional expense must be incurred to have it scraped off again. Now the remedy is very simple. Suppose the material to be gravel, which by some persons is called pit-flint: let it be dug and sifted, in the first instance, through a three-quarter inch sieve, *i. e.*, a sieve having the wires at the distance of three-quarters of an inch from centre to centre. When so far prepared, let it be broken by persons in a sitting posture with small hammers, and to such an extent that no stone shall be larger than two inches. When so broken, procure sieves having the wires one inch and a quarter from centre to centre, and let the gravel be sifted through them. This operation will be the means of sorting them.

The largest size should be laid on in the winter, in any moist or bad situation, it being first ascertained that no stone exceeds two inches. If it should appear to have been ill broken, a two-inch sieve must be at hand to sort, as no stone of larger dimensions ought to be laid on a road. All that passed through the inch and quarter sieve, when required for use (which should be in the spring, as the last coat for the season), must be put into the three-quarter inch sieve, when being put into the cart. This will cleanse it of all pernicious matter, leaving nothing but stone to go on the road. It must not be urged that a waste of materials takes place by this last sifting, because that would be but a poor argument against the practice. The small portion of useful substance which will pass through the three-quarter inch sieve, is of no value to the road, and, when compared to the improvement which takes place in the quality of the gravel owing to the sifting, it ought not to bear a moment's consideration. These siftings will make excellent stuff for the footways, and if of a bright colour are of value for gardens.

To some persons the process here described will appear to be expensive and tedious, but unless it be adopted, a road cannot be made good and cheap. Upon examination and experience, it will be found to cause *as* much less annual expenditure in the repair of a road, *as* the road itself will be superior to the old ones. Let us see what the expense of preparing the materials according to the plan described will amount to.

The old method used to be, to sift once (although not even once in all cases), which brought it into the same state as it is in by the new mode, before being broken. Then, when the rate of wages is two shillings a day, *pit gravel* of the average degree of quality, can be broken for sixpence per cubic yard, so that no stone shall be larger than two inches. The price paid for sorting through an inch and quarter sieve has been two-pence per cubic yard, and the next additional expense is for an extra man when loading, that the portion which passed through the inch and quarter sieve may be cleansed by screening it again in the three-quarter inch sieve, and will

amount to one penny a yard. These three items of expense amount to nine-pence per cubic yard. For this sum the materials are brought into a state perfectly proper for making a good road.

Now if the ill-prepared materials could make a good road, this expense, of course, ought to be avoided, but as that has been found, from woful experience, to be impossible, the practice here laid down ought to be resorted to.

It is believed that few surveyors, even of reputation, take *so much* pains in this particular as they ought to do, and yet they make passable roads; but it does not follow that if more care and nicety were shown, their roads would not be still better, and kept at less expense. It is confidently asserted, from experience, that their practice would be more reasonable and economical, were they to follow this course of preparation and sorting: first, because it is evidently wrong to lay on dirt, to be under the necessity of scraping it off again; and, secondly, because it is desirable, in order to prevent unevenness of surface, to lay on materials of one uniform size, whether that size be larger or smaller.

When the expense of the old system, as far as regards materials only, is rightly calculated, it will appear that as much cost has been incurred for a pernicious or useless substance, as the labour of preparing and sorting amounts to. Let it be considered, that if a cubic yard of gravel, delivered on the road unbroken in both cases, cost two shillings and sixpence, and in its unprepared state it contain only one-tenth part clay or dirt, this would amount to three-pence out of the two shillings and sixpence. Now it has been shown, that for this three-pence the gravel can be sorted and sifted, so as to cleanse it of this matter. The money, therefore, which has hitherto been paid for worse than useless material, is, by the practice herein described, expended in rendering it fit for making a sound, good, and clean road. In this comparative statement, the expense afterwards necessary to be incurred in scraping off the dirt brought upon the road by the old system, is left out of the question; but the reader's own imagination may conceive the difference of expense which must arise between the two courses. Attention must, therefore, be paid, in a most decided manner, to the preparation of the materials in the way described, not only to save expense, but in order to produce the most perfect state of repair.

SIZE OF MATERIALS.

It has before been said, that no stone should be larger than two inches; but this remark applied only to gravel, or other brittle substance. The tougher the nature of the material, however, the smaller the size should be. Granite broken to the size of an inch cube, must make a more durable and better road than if broken to the size of two inches: upon this principle, viz., the weight of a cubic yard of granite in a solid stone is forty-two cwt.; when broken to the size of three inches, it loses more than half its weight. Nevertheless, when once the solid stone is broken, the smaller the pieces into which it is divided, the more it approaches the solid stone again; consequently, the more minutely you break the materials, the greater will be the weight of the cubic yard; because there will be more stone in it, and a smaller portion of interstices.

The interstices, when the material is on the road, become occupied by matter of inferior and pernicious quality, such as mud, water, &c., and, therefore, the more nearly you approach the solid the better. If the thickness or depth of substance of road should be twelve inches, surely it is better to cause that twelve inches to be composed of as much granite, or hard material, as possible; and the way to effect this, is to bring it as near to the solid stone as you can, by breaking the pieces into minute parts. You

will approach then to the solidity of the paved streets, with the advantage of having your surface cemented together, instead of its being liable to be disturbed by the displacing of the separate stones.

It has been laid down as a principle, that "the tougher the nature of the material the smaller the size should be;" because if a brittle substance, like flint, be too minutely broken, or rather if it be struck with a hammer beyond a certain point, it will fly into powder. It is upon this account that directions are given to break flint or gravel, so that no stone be larger than two inches. In reducing them to this size, there will, of course, be many stones of much smaller dimensions, but there should be none larger. If they be larger, and the materials not sorted, but laid on all promiscuously together, the large stones will appear above the general surface of the road as wear takes place; and, on the other hand, if sorted, the larger size will, upon the principle before laid down, not form so solid or good a road as when broken to the proper dimensions. There are many kinds of flint and gravel, some more elastic or less brittle than others; and it is necessary, therefore, for a surveyor, before determining upon the size to which he will have them broken, to examine into the nature and quality of them.

QUANTITY OF MATERIALS TO BE LAID ON AT ONE TIME.

This is a point of great consideration, and one in which the greatest error in management is shown. The extreme importance of this part of the art seems to be overlooked, not by the commonplace and inefficient officers only, but by many of the most zealous and able surveyors. It is the practice of the first and most eminent men in this department of useful science, to lay on materials of several inches of thickness in one coat, without even opening the surface to receive them.

We contend, from reason and practice, that such a course of proceeding is altogether extravagant, and has a bad effect. It should not be followed under any circumstances; not even where there is too thin a substance of road, and where they are laid on with the view of increasing it, or bringing the road up to its proper point of power.

When a thick coat is laid on, the destruction of the material is very great before it becomes settled or incorporated with the road. The stones will not allow each other to be quiet, but are continually elbowing one another, and driving their neighbours to the left and right, above and below. This constant motion has the effect of wearing off the angular points, and of producing mud or dirt, and of reducing the stones to a circular form. When in this state, their chance of becoming fixed and incorporated is in a great measure done away and destroyed; and the road is consequently never seen in its proper shape. Whenever pressure is applied the stone yields, and instead of the carriage passing over it without injury, it is constantly upon the fret and wear, and in a short time more material is considered necessary.

It is one of the greatest mistakes in road-making that can be committed, to lay on thick coats of materials, and when understood will be no longer resorted to. If there be substance enough already in the road, and which, indeed, should always be carefully kept up, it will never be right to put on more than a stone's thickness at a time. A cubic yard nicely prepared and broken, as before described, to a rod superficial, will be quite enough for a coat, and if accurately noticed, will be found to last as long as double the quantity put on unprepared and in thick layers. There is no grinding to pieces when so applied; the angles are preserved, and the material is out of sight and incorporated in a very little time. Each stone becomes fixed directly, and keeps it place, thereby escaping the wear and fretting which occur in the other case.

Supposing it necessary to increase the substance of road, and it is intended to apply materials for that purpose, and not merely to make good the wear and tear, it should be done in like manner by thin coats. As soon as one is embodied, apply another and another, until the desired power be obtained, but by no means put the whole thickness on at once. When that is done, the road remains in a loose, unsettled state for a tedious time, rendering the draught distressingly heavy and annoying to the public, with a great loss of material, as before described. Besides which, the sections will be found, when the metal is at last embodied, very imperfect. The wheels will have followed each other in a line, causing ruts and irregularities. The sides will have become worn down before the centre of the road, and the surface generally will present anything but a true and even section. It will also be loose, and composed of the small particles of the material which itself has caused, and when much labour has been bestowed in scraping it off, the substance will be found not to have increased in proportion to the quantity laid on.

The point to be obtained is, a hard crust or surface, which is to come into immediate contact with the tire of the wheels; a surface which will cause as little friction as possible, when pressed upon by the passing weights. This, then, by the one practice, can be effected in a much greater degree than by the other. By preparing the material as before described, there will be nothing but the clear stones to be laid on; and by opening the road to receive them, and putting a coat of a stone's thickness at a time, no grit is produced. The stones form a new crust, composed of nothing but hard substance; and the consequence is, that much less opposing matter is presented to the wheel, and the draught is therefore lighter. When the draught is lighter, the wear and tear is less, and the result is, that the slight coat will last as long as the expensive thick coat. Which is the most desirable practice must be obvious to every one.

LIFTING.

Of the utility, indeed, of the absolute necessity of this operation, no doubt can be entertained by any one who has once put it into practice. It will be found of the utmost importance in dealing with *parish* roads, which, for the most part, have scarcely a true section in them.

Supposing a road is to be put in order which is found to contain a vast quantity of large flints or stones, which from time beyond the memory of man have lain there undisturbed. The form of the road is hideous to view, and absolutely dangerous to travel upon. In some parts one side of the road is a great deal higher than the other, containing immense obstacles to your passage, in the shape of hillocks of stone, from the top of which away goes the wheel into a hole, corresponding in depth with the height of the hillock, and altogether forming a section sufficient, without great care on the part of the driver, to overturn the carriage. Now, how can such a road as this be dealt with but by going to the root of the evil? To apply more materials when there are too many already would be absurd; yet such would be the practice of the old school. Cart-loads of the same huge materials would be brought and shot down, as little prepared as the road itself is to receive them. What must ensue from such a course of proceeding but a continuation of the same form of road; to be travelled over in the same rough, dangerous, and miserable condition? A great expense, however, will have been incurred in carting these huge masses to the road, but no Improvement effected. Surely it must appear evident that the simple mode of proceeding would be, to provide those poor industrious people, who would cheerfully work if they could find employ-

ment, with pick-axes, shovels, hammers, and rakes. Then to direct them to strike well into the root of the evil, to pick up this misshapen piece of work to such a depth, that the section of the road may be made true; that all the stones that may be found there may be taken out and broken, and when so broken again returned to it. In many instances more materials will be found than the road requires; and again, in some instances, there may not be substance enough. Under such a state of things, it is obvious what course should be pursued, so as to render the purchase of additional materials unnecessary.

Here, then, we find nothing but *manual labour* required, effectually directed by the practised surveyor; and it may fairly be deduced that, instead of incurring a large expense in cartage, without producing any improvement, a good road will be made without much, if any, additional cost. This may be asserted, because the power which has been employed in it would have remained unproductive and supported in its idleness by the same parties who have the charge upon them of repairing the highways. However, even setting that consideration aside, and looking only to the absolute cost of the two systems in this one single case of repair, it will appear that the new practice is decidedly the cheapest; for example, the old school, with a view of repairing this unfortunate-looking road, would bring two cubic yards of materials at the least to the rod superficial, which at a moderate computation would cost 3*s*., but more probably 5*s*. per yard, which would be 6*s*. per rod. The lifting in the case similar to that described would be done for 1*s*. per rod superficial, and the breaking the flints which would come out would cost 1*s*. per cubic yard. Now, even if two cubic yards per rod should be taken out of the road so lifted, the expense would not amount to more than half of the cost of the old practice. To say nothing, then, of the saving in a course of years by the durability of a road formed under the new system, and which has been found in some cases even where the traffic is considerable, by the side of a large town, to last for seven years without an additional stone being applied; to say nothing of the saving to the public in wear and tear of horses, carts, and tackle; to say nothing of the comfort of travelling a smooth road; and also to say nothing of employment being, by the new system, found for the poor: yet a road can be maintained good and perfect for half the sum under the new system, which, under the old, is expended without improvement.

The mode of lifting just described applies to roads in the worst condition as to the sections and former preparation of the materials. There are other cases which call for the operation of lifting. The next is, when the road is partially out of form, having at the same time in its substance materials the nature of which is not large, but consisting of inferior pebbly stuff. Here we must not go to the extent and depth, as in the last case, but just pick it up sufficiently to produce a good section. Here, too, perhaps, there is not weight of metal enough to sustain the burthens the road is liable to. If so, after the lifting is performed, and before the surface becomes settled, a coat must be applied; and attention must be paid to the surface, by scratching it with the tooth-rake regularly all over, as occasion requires.

Lifting again must be resorted to when granite or other material of the hardest kind is used, and which has been for some time the usual substance provided for the road. It is more particularly necessary to loosen the surface which contains granite, because the additional supply cannot so readily become incorporated when the road is already hard. The two substances being of similar hardness, oppose each other for the possession of the surface; the one, however, which is already fixed has the advantage over the one newly brought on, and the consequence is that it becomes partially worn

away by the action of the wheels before it is forced into the society of the rest. If granite were proposed to be laid on a gravelled road, there would not be *so much* necessity for lifting, because the weaker must give way to the stronger substance; at the same time it would be advisable in this case to loosen the surface to admit granite. In the operation, however, it would not be necessary to do more than just to bury the point of the pick-axe to the depth of an inch and a half, to produce, as it were, a soft bed for the granite to repose upon, bearing in mind a former injunction, not to lay on more than a cubic yard to a rod superficial. The object to be gained by lifting, when additional materials are applied, is, that they may become incorporated immediately before any injury has been done to them by the wheels. When the surface is open, each stone takes its place as soon as laid on, and is enabled to retain its place by the assistance which the angles afford it. On the contrary, if the road be hard and not opened, a great portion of the material is destroyed and rendered useless before incorporation, and the grit arising from the pulverization causes the draught to be heavy. In all cases, then, but when the road is extremely wet and soft, it will be advisable to open the surface to receive metal.

On hilly parts of the road in particular, lifting should be resorted to at all times. If stones be laid on in these places they cannot be expected to unite with the road in the same position as they were intended to do if not lified. They will, of course, work longitudinally down the hill, and also roll on either side into the watertables. The necessity for having the cross sections sharper down a declivity, in order to draw away the water quickly, causes the material to roll more rapidly off the road.

TRANSVERSE SECTIONS.

If a man be not sensible of the necessity of true cross sections in road-making, he is not qualified for a surveyor. How can the surface-water escape, if the sides of a road be higher than the centre? It must remain soaking into the materials, rendering them soft and powerless, and causing rapid decay to all the substances within its influence. This, one would imagine, must be known to all, and yet how little attention is paid to this part of the subject. Even on roads having great traffic, and to which one would expect particular attention to be paid, the grossest errors in this respect are committed.

A road should fall transversely from the centre to the watertables at the rate of 1 in 24 along flats or level ground, and sharper in proportion as declivity increases. It is made rounder, or the section is sharper down a hill, that the water may be the more quickly carried off to the sides into the watertables, for, if not quickly carried there, it will run longitudinally down the road, to its great injury. Let it be borne in mind that the boldest surgeon makes the best cure. If, therefore, the road be defective in its transverse sections, showing the watertables higher than the centre, be not afraid to cut deep, always remembering that the true form must be produced, and that if you stop short but one inch in the operation, no good will have been effected. It is well known that in cauterizing a wound, if but a small particle of gangrene remains, the cure is not accomplished, and mischief ensues; so in road-making, if the watertable be in the slightest degree higher than it should be, the water cannot be drained into it. Fear not, then, but cut on; and if, in obtaining the proper fall, you are driven into the substratum, and have no hard substance left, take out the substratum still deeper, and fill up with sound materials. It is necessary, and perhaps more necessary, to have as great a degree of substance at the sides as at the centre of the road, particularly where the traffic is great. In passing each other, carriages must travel on the sides; and if there be a formed footway,

it will be found that carters use it, keeping their teams on the sides of the road just within reach of the whip. Be careful, however, not to make the section sharper than in the above proportions, if the groond lie tolerably level, fur if a road possess too much of convexity, the chance is destroyed of keeping the materials fixed and well embodied. The bearing of the wheel is then not perpendicular, and has a tendency to displace the metal, particularly if of a circular form, and the draught becomes heavier for the horses. When the repair of a road is well cunducted, the body of it will be sound and the surface smooth; and when so, a very slight convexity will serve to carry off the water, which is the only motive for keeping any convexity at all.

Again, when a road is very round, the carriages are naturally enough conducted along the crown of it, causing it to be worn much in that part, and but little in the other parts, and thereby producing rots. The foundation, therefore, shoold possess the same section as the surface, and an uniform thickness of materials be fuund upon it. When this is the case, the road will be more likely to be kept dry, than when it is made flat, and the surface section obtained, by having a thicker substance of metal at the centre than at the sides.

ONE-SIDED ROADS.

All principle is against the form of one-sided roads, yet they are to be seen in every direction. In order to keep a good road it is necessary to draw off the water as soon as possible, that the materials may not be sacrificed, and that the draoght may be light. Will a one-sided ruad effect this? —No. The water has to pass over twice the surface of road before it reaches the watertables; and the result is, that the lower part of the one-sided road becomes doubly saturated with water, and the wear unequal. This calls for an additional coat in that part of the road, and causes a system of repair which militates against the chance of having a true surface. If first one side of a road be coated and then the other, it is very difficult to obtain equal wear over the whole. An endeavuur should be made to cover all the surface at once, and so slightly, that the public may not fear to travel over all parts alike. But this will not take place on one-sided roads, fur the reason just given.

Then, to cause as little wear as possible, the pressure upon the surface should be perpendicular. On a one-sided road a carriage cannot stand upright, for the weight bears more upon one wheel than another, and not only more upon one wheel than another, but upon one edge of that wheel. It has a constant tendency to slide towards the lower side of the road, and by that motion displace the materials. The shifting of the materials renders the road heavier to travel upon, and a compound motiun being produced by the tendency of the wheel so to work down to the watertables, the draught is made still heavier for the horses. There are very few cases which will justify the practice of having one-sided roads, for the reasons above stated.

SPREADINO.

Having gone through all the preliminaries necessary to be described before the coat is laid on, we must now describe the manner in which this should be done.

To the generality of persons it will seem that, to say anything upon this point must be superfluous, but it is not so. Much more depends upon this operation than a casual observer would suppose. In fact, it would be impossible to obtain a true section if this part of the art be neglected. The

general mode of doing it is, to have the load shot down upon the spot which is supposed to require additional materials; a portion of it is then pushed to the right and left, and the main body left upon that part of the road where it was first placed. The consequence is, that the part of the surface containing the greatest portion of materials will, when those materials are embodied, present a section of great inequality. The carriage will then have an undulating motion, very distressing to the parties travelling by it.

The proper mode of spreading is this: To cause the load to be shot down a short distance from the place upon which you wish the materials finally to be spread; and to direct the spreader to cast every shovelfull from him equally all over the surface, and in such a manner as he would do if he were sowing wheat broad-cast. The road will then be not thicker in one place than another, and a section will be produced, perfect and true.

THE RAKE.

The rake is a very useful implement, but at the same time, if the practice herein described, of laying on coats of only a stone's thickness at a time, be adopted, it will not be so much called for as in the old practice of thick coating. However, it should always be at hand to level any irregularities which may occur whilst the materials are going down. If any ruts appear this tool must be used to keep a regular even surface, but caution must be observed in its application. The labourer, if left to himself, when a rut shows itself, will gather all the loose stones he can find, and draw them into the rut, with the view of levelling it; but this does mischief, and should not be allowed, because by doing so he causes the road to be harder in those places than the rest of the road. In the summer, it will present an uneven surface, showing longitudinal ridges where the ruts were, and be the means of forming a barrier to the escape of the water. In using the rake, then, let him work it backwards and forwards on each side of the rut, and across it, and if he do it with his eyes shut, he will do more good than by taking pains to gather all the stones he can find to place in it.

SCRAPING.

If it be desirable to keep a road dry at the foundation, it must be equally so at the surface. By drawing the water quickly from the surface, the drainage at the foundation is comparatively of less consequence, because it has not time to soak through to the bottom. If mud be allowed to remain on the road the water is impeded in its course towards the watertable, and by dwelling on the surface finds its way to the subsoil. Great mischief arises to the materials, and they are rendered soft and powerless, causing the draught to be very heavy, and the road unpleasant to be travelled upon. The moment, then, that mud appears let it be scraped off and removed immediately from the road.

SUN AND WIND.

If a road be inclosed by trees or high hedges, it will be impracticable to keep it good, and at the least expense. The additional charges are great when so situated. Every attention should be paid therefore to enforce the law, so as to have the hedges kept low and the trees trimmed. Too great indulgence is by the present act given with respect to trees, as a surveyor cannot compel parties to trim them up in all cases, for if situate in a garden, yard, park, or paddock, or if they may be deemed ornamental, or a shelter, he cannot touch them. In general, it is considered that private

interests should yield to public good, but in this instance the rule is departed from, to the great inconvenience and annoyance of the traveller.

EVIL EFFECT OF BADLY-FORMED ROADS.

If the generality of persons knew how much more they are called upon to pay for the support of roads which they are daily travelling over than is necessary for their repair, more anxiety would be shown to have the system altered; but the fact is, their attention is not directed to the subject. So long as they can pass and repass with any tolerable degree of security they murmur not. Nothing is said one way or the other. If they cannot do this, and great inconvenience occurs, then a little stir is made to remedy it, and as soon as they can pass again as usual they are quiet. The expense is not looked to in either case whether the passage be good or bad. True it is, however, that the better the state of passage, the less the charges for such passage.

When the section is true, the surface smooth and dry, with no irregular rities, the less the wear and tear. If large stones are laid on, intermixed with smaller ones, after a little while the large stones appear above the general surface, causing it to be rough and uneven. The wear and tear then becomes progressively greater. The wheel drops from the top of the protruding stones, making a hole on each side of it. In these holes the water dwells, decomposing the materials at a rapid rate, and faster and more fast the road decays; so if the coats be imperfectly spread, the section becomes defective, with every here and there a pool of water appearing. This again ruins the power of the metal, and the surface being irregular, great friction ensues, and wear takes place rapidly. Not so when the repair is properly conducted. The carriage-wheel, having no obstacle presented to it, passes evenly and uniformly along; it does not press more in one place than in another, and the materials are not displaced. The substance of the road is not decomposed by water lodging, but remains sound and hard, capable of resisting the pressure above. A great failing in many roads also is, that sufficient power is not given to them; they are always below the mark. When this is the case, a true section cannot be preserved; the want of power causes it to yield to the pressure. The materials are worked backwards and forwards by the passing wheels, and when in this state the wear is enormous. It is similar to patching up on old waggon-wheel, which being unequal to the weight it has to carry, is continually breaking down, incurring fresh expense to repair it. When a road is once well up to the mark, in good form, and in every respect attended to, the wear is trifling in comparison with an ill-managed and a neglected road, proving that economy is best consulted by an early attention to the first symptoms of decay.

There is no doubt, *because it has been proved by practice*, that where a road is managed upon the principles here laid down, it can be kept in high condition for fifty per cent. of the cost under the old system of repair. Taking the parish roads throughout the kingdom, it may with safety be asserted that they may be kept in repair, in as good repair as the turnpike roads, at a great deal less expense than is at present laid out upon them. The poor would be employed, and the poor-rate reduced; a great saving in the wear and tear of horses, carts, and tackle would be effected; heavier loads moved with less strength; time saved; and the case and comfort of the public greatly increased.

EFFECT UPON A ROAD OF DIFFERENT WIDTHS OF WHEEL.

The amount of injury done to a road by weights passing over it, and

the rate at which that injury is modified by the width of the wheels, is a matter very difficult to ascertain. It depends much upon the materials of which the road is made, the state of the weather, the form of the road, the part of the road over which the weight goes, and perhaps the speed of the carriage. Thus experiments are difficult to make. This, however, may be safely affirmed, that on the one hand scarcely any toll will compensate for the injury done by a great weight conveyed on narrow wheels; and on the other hand, a weight may be so excessive as to be injurious upon any width of wheel which it is reasonable to suppose may be used.

Injurious action upon the surface of the road, diminishes progressively as the width of the felloe of the wheel increases, provided the weight be not excessive. A wheel may so increase in width as to act as a roller or compresser; and, within certain limits, the heavier the roller, the more effectual it is in producing the desired effect, viz., compression. Thus, although a wheel shall carry weight for inches, it may approach, as the width of the felloe increases, to the point at which, instead of causing injury, it will benefit a road.

Then, as to the mode of levying Toll in order to be reimbursed for the injury done by each wheel.

The Lords' Report in 1833, upon the subject of the weight to be carried, is this:

"The supposed benefits to be derived from limiting the weights to be conveyed on roads have been so much defeated by the practice of compounding for overweights, that they recommend the abolition of the use of weighing engines."

Perhaps the best practical check upon the amount of weight to be carried, consists in putting the toll upon the strength employed; *i. e.*, the number of horses drawing; for no person who knows his own interest will use less strength than is fairly necessary, unless the high amount of toll be a prohibition.

So far as observation is capable of ascertaining results, the injury done to a road appears to the Author to be one-fourth in amount as the width of wheel doubles, supposing each sort of wheel to carry the same weight.

Supposing a 3-inch wheel to pay		. .	6*d*. per horse.
$4\frac{1}{2}$	ditto	,, . .	$4\frac{1}{2}d$.
6	ditto	,, . .	3*d*.
9	ditto	,, . .	$1\frac{1}{2}d$.

The amount of weight to be carried may, with little risk, be left open; for the high rate of toll will be a check upon heavy weights being conveyed upon the narrow wheel in a bad state of road: which will only be practised when the roads run light, and when the weight can be moved with less strength, and less injury. For the worse the state of the road, the smaller will be the relative degree of draught upon the broad wheel; and thus in proportion to the good or bad state of road, should a narrow or broad wheel be used.

If the road be weak, spongy, and loose, the draught will be lighter upon the broad wheel; and *vice versâ*, if the road be sound and good, the draught will be easier upon the narrow tire. The use of the different widths of wheel will vary as the state of the road varies, from the fallow field to the iron railway. Not so the wear; that remains relatively the same, be the road good or bad: for a narrow wheel will wear out an iron rail in the same relative proportion as a turnpike road, and in all states of a road will carry with it the same relative degree of injury. Perhaps immediately upon the breaking up of a frost, the broad wheel will lick up and carry the crust

of a road from one place to another, and cause it to be out of shape until re-formed again; but then in such a state of road the narrow wheel will cut through to the foundation, and create mischief in that respect. But conceding that, under such circumstances the broad does do more injury than the narrow wheel, it is but for a very short period of the year, perhaps only for a day or two, and bears no comparison at all with the great degree of injury a narrow wheel occasions all the rest of the year. If it were nicely observed, a narrow wheel, although the road shall be in a hard state, will be found to have caused much greater pulverization after passing along a road than the other wheel; and it is only because the road, when in a hard state, does not show the wear so conspicuously, that it is thought by some persons to do no more harm than the broad wheel.

It may be a matter of consideration, whether the narrow wheel shall not be allowed greater latitude or indulgence, when the roads are brought to greater perfection than at present, seeing that the draught upon them is lighter relatively with the broad, as the condition of the road improves, and more advantageous for the public to use. In the present state of most of the roads in the kingdom, it would be ruinous to the Trusts to encourage the use of narrow wheels by an abatement of toll. If indulgence be given to the narrow wheel, it will be the means of reducing roads to a generally bad state of repair; when so reduced recourse must be again had to the broad wheel, so that by such a policy, the only result would be, that a temporary indulgence will have been given to the narrow wheel, at the expense of a reduced state of repair, loss of income, and to the annoyance of the public.

SHAPE OF WHEEL.

Having endeavoured to describe and settle the degree of injury which is done to a road by wheels of different dimensions, it is now necessary to say a word or two upon the effect which wheels of different *shape* have upon the wear of a road, and the draught they occasion.

It is obviously true, that the wheel of a cylindrical form has the advantage of the wheel of a conical form, both as far as regards the wear of the road, and the draught for the horses. The cylindrical wheel stands upright, having a perpendicular pressure on the road, and the felloe being parallel with itself, the periphery is the same inside as outside; whereas the conical wheel is made of a dishing shape, the bearing or direction of the felloe, instead of being parallel with itself, inclines to a point forming a cone, the base of which is the inner periphery of the wheel, and the apex a point ascertained by producing the lines of felloe, formed by the inner and outer periphery.

The conical wheel, then, from its peculiar construction, having the inside greater than the outside circumference, and being obliged to go forward in a right line, causes a compound motion, which in its progress produces a screwing or grinding effect upon the materials, and in a measure displaces them. This injures the road, and makes the draught heavier.

On the other hand, in favour of the conical wheel, there is more room given for the body of the carriage; and also by its standing out from the body, the cart itself, in crowded streets, is protected, in case of collision with another cart, the projecting part of the wheels alone coming in contact, and gently rubbing one another off. As far, however, as regards the wear of the road, the upright or cylindrical wheel ought to be encouraged.

Then with regard to the shape of the felloe. It will be seen that the general practice has been to make a six-inch felloe, in a great degree circular, instead of flat, which, of course, has had the effect of injuring the roads, and of deluding the trustees of the turnpikes. Much of the dislike

which has been felt by some surveyors to the broad-wheel, has arisen from this cause, and with reason. The six-inch wheel is allowed to carry greater weights than the narrow wheel, and pays at the same time less toll. The circular form of the felloe prevents the whole six inches from bearing upon the road, and, in many instances, will be found to roll no greater surface than the three-inch wheel.

If, then, it is allowed to carry more weight, and pay less toll, the objection of the surveyor is very natural. It probably, under these circumstances, has double the advantage of the narrow wheel, or is of double injury to the trust. Provision ought therefore to be made, that the whole professed width of felloe be made *flat*, so that it bear upon an equal superficies of road. If so provided for, the injury done by each sort of wheel will be found to be equal to the amount described in the scale herein given.

EFFECT OF WATERING ROADS.

The introduction of the water-cart, both as far as regards the comfort of the traveller and the preservation of the road, may be considered one of the greatest improvements recently adopted. The advantage to the traveller is of course obvious, as far as his own comfort is concerned; but if the watering be carried to too great an extent, he does not derive any benefit with respect to draught. If the road be saturated with water, so as to create mud, a state of surface is produced, little less heavy for the horses than winter itself causes. When the operation is judiciously performed, the materials are preserved from that degree of pulverization which, in a dry summer, invariably takes place. On a road, repaired *with flints* or *gravel*, or *any other brittle material*, the wear from drought is very great. As dry weather continues, the materials become loosened, and the surface presents an appearance of a coat newly laid on. The action of the wheels produces a great degree of pulverization, and the wind carries off the materials so reduced to a powder.

If there be no wind for any length of time, an accumulation of dust takes place, which is obliged to be scraped off; and thus the road becomes impoverished, losing rapidly the substance necessary to support weights; and rendering necessary additional coats, so soon as the weather will allow them to be put on.

Now a well-directed supply of water, equally distributed over the surface, tends to prevent this effect. It keeps the crust of the road settled, it supports the materials in their places, preserving the cement necessary for this purpose. When, however, the distribution of the water is too heavy, or irregular, mischief is done to the road, and wear will be caused in as great a proportion by over watering, as by not watering at all. Decomposition of the substances contained in the road ensues, in proportion to the over supply of water necessary merely to settle the surface. There is a point, therefore, at which the quantity required to effect good may be exceeded, and it requires some judgment, and a good deal of attention, to direct the use of the water-cart.

Again, if the carts be not scientifically constructed, the water will be distributed in streams, throwing a greater quantity in one place than in another; and when that is the case the wear of the road will be unequal. A road also may be watered too slightly: when it is so, the crust, or rather the loose dust, will appear adhering to the wheel, causing a heavier draught than if not watered at all, and injuring the road.

So great is the benefit of judicious watering to a road composed of materials which in themselves *are brittle*, that it may be considered advisable to

use the water-cart for the sake of the road itself, setting aside any consideration which the public may be entitled to.

CARTAGE.

It has before been said, that the object of this little essay is intended to bear chiefly upon the system of managing *parish roads*. This head of the work applies particularly to the mode by which the carting is done under the present highway laws. In this item of expenses lies one of the greatest grievances, seeing that it forms a main part of the expenditure in the repair of parish roads, and by its evil tendency causes a ruinous state of repair. The system of statute-duty naturally induces a larger outlay to take place in horse labour, than would otherwise occur, even under the present mode of appointing surveyors. If the parish surveyor collected all his revenue in money, and had to pay hard cash for the horse-work done, he would not lay out so much in that description of labour as he now does.

At present the nominal amount is very great, without a corresponding benefit being received. In many cases, indeed, the effect is greatly injurious, causing additional materials to be heaped upon the road, when there is already an abundance. It substitutes an imperfect, not to say injurious mode of repairing roads, for a perfect and beneficial one.

It is one part of the proposition set forth in the beginning of this work, to do away the statute-duty, which is not only complicated in its mode of being ascertained and called out, but which has been shown to bear unequally and unfairly upon the rate-payers. If done away, the horse-work necessary to be performed, in bringing such materials as may be required, may be executed by those persons who are to be assessed for the horses they keep, in fair proportions, and be paid for the same by the scale before alluded to.

For example: At the beginning of a new year of repair, it will be ascertained by the surveyor, as near as may be, how many cubic yards of gravel, &c., he will require for the supply of his roads during the current year, and what distance they will have to be carted. He will know, by his rate, how many horses each person will be charged with. Then apportioning the number of yards of materials to the number of horses kept, he will give the option to each party, to cart such a number such a distance. According to that distance he will be paid the sum described in the table or scale; and thus every one will receive a fair remuneration for the work done. This head of expenditure will by this means be fairly and equally regulated.

The horse-work is very differently conducted in the shape of statute-duty, and a great loss in horse-power is consumed in idleness. To give an idea of the difference in the amount of work which is done as statute-duty, and when done as piece-work, or paid by the table, the following case, amongst many others which might be enumerated, is here related, and which actually took place.

Two parties were set to work to cart materials from the same pit to the same place. The one understood that he would be paid for the work he did according to the table, at so much per furlong per cubic yard, the other thought he was working out his statute-duty. The one sent two horses and man and cart, and carried a yard and a half of materials at a time, and in the course of the day carted 16½ yards, which, at 7½*d.* per yard, the price allowed by the scale, came to 10*s.* 3¾*d.* The other sent three horses, man and boy, and carted 10½ yards, for which, as statute-duty, he was entitled to 15*s.*, being the price of a team, as fixed upon by the magistrates. The cost to the parish, therefore, by statute-duty, was 17*d.* instead of 7½*d.* per yard.

The table here alluded to is founded upon the following principles :—

That three horses, a man and boy, with proper carts, &c., should earn 15*s.* per day, when oats sell at 20*s.* per quarter.

That as a horse is to earn 5*s.* per day, it must be calculated what he ought to be paid to enable him to do so, and what quantity of work should be done for the money.

That a team should travel ten miles out and in for a day's work. That this should be done in eight hours, which is at the rate of a mile in forty-eight minutes, or a furlong in six minutes. That six minutes be allowed for shooting the load, and for shifting the horses from one cart to another each turn. That having thus the length of the day given, and the rate of travelling, with the allowance of time for shooting and shifting, the number of cubic yards which should be carted in a day is easily ascertained.

Thus the length from the pit to the place of shooting the materials upon the road, shall be taken as four furlongs, which, according to the given rate of travelling, will occupy twenty-four minutes, and the shooting six minutes, equal to thirty minutes.

Therefore, 480 minutes, or eight hours, the length of the day, divided by 30, will give 16, the number of turns a team should go in a day, the distance being half a mile from the pit to the place of shooting.

Then two horses with a cart should carry a cubic yard and a half of materials at a time, which will give 24 yards in the day. Now two horses are to earn ten shillings, as shown, which, divided by 24, the number of yards to be carted for that money, gives 5*d.* per yard, the proper price to be given for carting a cubic yard of materials the before-mentioned distance, when oats are at 20*s.* per quarter.

A CALCULATION, OR TABLE

For regulating the Prices to be given per Cubic Yard for Carting on the Highways of England.

Distance in Miles and Furlongs.	Number of times a Team should go in a Day.	Number of Cube Yards with Two Horses.	Price when Oats sell at 20s. per quarter.	Price when at 25s.	Price when at 30s.	Price when at 35s.
	•		Equal to per day 10s.	Per Day 11s.	Per Day 12s.	Per Day 12s.
m. f.			d.dec.	d. dec.	d. dec.	d. dec.
0 1	40.	60.	2.0	2.2	2.4	2.6
0 2	20.666	39.999	3.0	3.3	3.6	3.9
0 3	20.000	30.000	4.0	4.4	4.8	5.2
0 4	16.000	24.000	5.0	5.5	6.0	6.5
0 5	13.333	19.999	6.0	6.6	7.2	7.8
0 6	11.428	17.142	7.0	7.7	8.4	9.1
0 7	10.000	15.000	8.0	8.8	9.6	10.4
1 0	8.888	13.332	9.0	9.9	10.8	11.7
1 1	8.000	12.000	10.0	11.0	12.0	13.0
1 2	7.272	10.908	11.0	12.1	13.2	14.3
1 3	6.666	9.999	12.0	13.2	14.4	15.6
1 4	6.154	9.231	13.0	14.3	15.6	16.9
1 5	5.714	8.671	14.0	15.4	16.8	18.2
1 6	5.333	7.999	15.0	16.5	18.0	19.5
1 7	5.000	7.509	16.0	17.6	19.2	20.8
2 0	4.705	7.059	17.0	18.7	20.4	22.1
2 1	4.444	6.666	18.0	19.8	21.6	23.4
2 2	4.210	6.315	19.0	20.9	22.8	24.7
2 3	4.000	6.000	20.0	22.0	24.0	26.0
2 4	3.809	5.713	21.0	23.1	25.2	27.3
2 5	3.636	5.454	22.0	24.2	26.4	28.6
2 6	3.478	5.217	23.0	25.3	27.6	29.9
2 7	3.333	4.999	24.0	26.4	28.8	31.2
3 0	3.200	4.800	25.0	27.5	30.0	32.5
3 1	3.076	4.614	26.0	28.6	31.2	33.8
3 2	2.962	4.443	27.0	29.7	32.4	35.1
3 3	2.857	4.285	28.0	30.8	33.6	36.4
3 4	2.759	4.138	29.0	31.9	34.8	37.7
3 5	2.666	3.999	30.0	33.0	36.0	39.0
3 6	2.580	3.870	31.0	34.1	37.2	40.3
3 7	2.500	3.750	32.0	35.2	38.4	41.6
4 0	2.424	3.636	33.0	36.3	39.6	42.9
4 1	2.353	3.530	34.0	37.4	40.8	44.2
4 2	2.286	3.429	35.0	38.5	42.0	45.5
4 3	2.222	3.333	36.0	39.6	43.2	46.8
4 4	2.162	3.243	37.0	40.7	44.4	48.1

HINTS

FOR THE

PRACTICAL ADMINISTRATION

OF THE

POOR LAWS.

UNDER THE SUPERINTENDENCE OF THE SOCIETY FOR THE DIFFUSION OF USEFUL KNOWLEDGE.

LONDON:
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HINTS

FOR

THE PRACTICAL ADMINISTRATION

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POOR LAWS.

ONE of the heaviest burthens borne by agriculturists is the Poor Rate: any practical mode of lessening the amount of this impost will not be unworthy our attention, especially if, at the same time, such diminution can be shown to be beneficial rather than injurious to the working classes.

The administration of the poor laws is confessedly very different in different parts of England, and as the effects of the difference are plainly perceived both in the amount of the rates and the depression of the workmen, it may be worth while to consider what is the best plan to adopt.

In one county, we shall find, the poor rates amount to 1*l.* per head on the whole population, as in Sussex; in another, it will only be 4*s.* per head, as in Lancashire; and while the local expenditure (of which far the largest portion is for the maintenance of the poor) is in some counties, as Sussex or Bedford, above 6*s.* in the pound on what is probably the full annual value,—in other counties, as in Northumberland, Cumberland, the North Riding of Yorkshire, and Shropshire, it varies from 1*s.* 7½*d.* to 2*s.* 5*d.* in the pound *.

That these differences in the amount of rates arise chiefly from the difference of management, we have the testimony of numerous able writers, and of several Reports of Parliamentary Committees, resting upon evi-

* Accounts of Local Taxation, ordered by the House of Commons to be printed, Dec. 6, 1830, paper 52. The information given is very important, and the deductions curious.

We have made, from the returns to Parliament, a calculation as to the proportion of the cost of the poor, comparing the average of the three years 1812, 13, and 14, with the three years 1827, 28, and 29. The average expenditure of the three former years was about 6,400,000*l.*, with corn at 102*s.* per quarter; of the three latter years, 6,300,000*l.*, with corn at 57*s.* per quarter. We have calculated that two-thirds of the expenditure on the poor varies with the price of corn. Then to maintain the same number of poor with the same proportioned allowances in the latter period, the cost ought to have stood—

One-third part of cost, stationary	£2,100,000
Two-thirds at rate of corn three last years, 46 per cent. reduced	2,200,000
	£4,300,000

but the actual cost is 6,300,000*l.*, that is, an excess of what it ought to be of nearly one half of what the whole should amount to. Making an allowance for the increase in population of 24 per cent. in the fifteen years, yet bearing in mind this has chiefly been in manufacturing counties, where the rates are not augmented in proportion, we shall come to a conclusion that there is an increase in the proportion of expenditure on the poor, and probably of the nnmbers of poor, of above one-fourth in fifteen years. The above calculation, if not quite exact, will show the main points deserving of atteation.

dence. Abuses of various kinds have been introduced, in many of the southern counties especially, productive of serious injury to the landowner and the peasantry.

The execution of the poor laws being generally left to the farmers of the parish, we shall endeavour, as briefly and clearly as possible, to point out how this important duty should be executed.

It seems evident that the execution of these laws, like every work undertaken by man, will be better executed by those who have experience in the matter, and who constantly attend to it, than by those who are unwillingly obliged to leave for a short time their usual occupations, to betake themselves to this rather unpleasant task. Hence it will be seen that it is not very likely that the old mode, still adhered to in many parishes, will succeed, of appointing annually two inhabitants as overseers, upon whom is to devolve for a twelvemonth the administration of the poor laws within the district. Unacquainted previously for the most part with the complex laws they have to administer, and having little personal knowledge of the applicants, they will content themselves generally with getting through the necessary business with as little trouble as possible, and will follow pretty nearly the practice of their predecessors, whatever it may be, especially if sanctioned by the neighbouring justices*. A twelvemonth having elapsed, (too short a period for the former overseers to become acquainted with their duty,) fresh ones are appointed, who have everything to learn! Such a system is almost sure to cause or perpetuate abuses.

If a parish be sincerely desirous to lessen their expenses and duly administer the law, their first step should be to appoint a permanent overseer, paid by the parish, answerable to the vestry, and removable for misconduct. It will be the business of this person to acquaint himself with the law, and his duty to execute it; he must devote himself to this object, and will soon become acquainted with the characters of applicants and the best mode of dealing with them.

There is no difficulty whatever in the appointment of such an officer. The rated inhabitants have only to meet together in vestry, and agree to employ such a paid overseer, and his appointment will be confirmed by the justices, as provided by the 59 Geo. III. c. 12†.

* 'Named only for one year, and in general anxious chiefly to get rid of his office with as little trouble to himself as possible;' or if 'he endeavours, in spite of clamour and vexation, to improve the practice, his designs are liable to be overset by the orders of magistrates.'—*Report on Labourers' Wages*, p. 6, 1824.

† It would be of the greatest advantage that some alteration should take place in the law, so as to allow to the *owner* of rated property, or his agent, considerable power in laying on the poor rate, and administering it when raised; in which case, the owner should contribute a certain proportion of the rate: at present it is under the sole control of the occupier, who pays the whole. The tenant-occupier, however, has not the same permanent interest in the proper management of the rate as the owner has: if the rates increase, the tenant on each fresh letting will make this a ground for a diminished rent, and often thinks it is for *his* interest to keep wages as low as possible, however high the rates may thereby be raised; and this accounts for some of the abuses of the poor law prevalent in several counties of the south of England. If the owner paid a proportion of the rate, its increase would be a salutary warning to him that some attention to the subject was necessary, and his interest would direct him to improve the condition of the workmen, as the only true and permanent mode of keeping the rates low. In ordinary cases and in agricultural districts, it is a general rule that rates and wages vary inversely to each other: if wages are high, rates are low; and if rates are high, wages are low. In Scotland, the rate is laid on by the heritors only, or their agents, in conjunction with the clergyman, and paid in equal portions by heritor and occupier, and expended by the minister and kirk session.

In above two thousand parishes such permanent overseers are now employed, and are, almost without exception, found highly useful: the amount of their remuneration is generally saved over and over to the parish by the diminution of other expenses.

If the parish in question be so small as not to require the constant attention of the permanent overseer, he may combine the business with the care of some adjacent parish or parishes similarly situated, or with any other occupation. The duties, however, to be performed, if duly executed, are so numerous, that in most parishes his time will be pretty much engaged, as will be seen when we come to consider how he ought to act.

We have stated that, in a parish containing small numbers, a permanent overseer, acting under the control of the annual overseers, may be sufficient; but in every populous parish there should also be a select or elected vestry, chosen under that useful Act of Parliament 59 Geo. III. c. 12, commonly called Mr. Sturges Bourne's Act, and consisting of any number, from five to twenty *.

These persons being chosen by the rate-payers, the latter are, of course, interested to choose such respectable and intelligent inhabitants as are likely to attend to a subject alike important to themselves, their neighbours, and the humbler classes. The services of these vestrymen are unpaid and voluntary; but as they may be re-elected or removed by the rate-payers at certain periods, it is not likely that others than those willing to do their best will consent to act.

The paid overseer is completely under the control of such a select vestry: it will be their duty to investigate and manage the parish expenditure; and they ought annually to publish a balance-sheet, for the satisfaction of the parishioners, drawn up in the same form for the convenience of comparing one year's outgoings with another's, and divided into separate heads of expense, in as simple and short a manner as possible, so as to be plain to the capacity of every rate-payer †.

Having thus a permanent overseer and (in a large parish) a select vestry, it is necessary, in order to carry the law into effect, that there should be, within or near the parish, an efficient workhouse and poorhouse. These may be either together or separate; but they are better separate, for reasons we shall soon state. In general they are united, and in many parishes, though there be a nominal workhouse, it really is nothing but a poorhouse.

Those to whom assistance is to be afforded from the poor rate, are described in the words of the important statute, 43 Eliz., c. 2, §. 1, as follows:—

'The churchwardens and overseers, with the consent of two justices, shall take order, from time to time, for setting to work the children of all such whose parents shall not, by the said churchwardens and overseers, or the greater part of them, be thought able to keep and maintain their children, and for *setting to work* all such persons, married or unmarried, having no means to maintain them, and using no ordinary and daily trade of life to get their living by; and for the necessary relief of the lame, im-

* 'The greatest evils arise from entrusting a business so complicated to inexperienced and inefficient officers; and much benefit has been produced by taking advantage of the provisions of 59 Geo. III. c. 12, on this subject.'—*Report on Labourers' Wages*, p. 8, 1824.

† At page 19 will be found a printed form of such summary or abstract of the annual receipt and expenditure of a parish.—*Appendix to the Report of the Select Committee on the Poor Laws*, 1819, paper 529. Such an abstract should be distributed, or placed on the church door, to prevent mismanagement.

potent, old, blind, and such other among them being poor and not able to work.'

In this concise form of words, which should never be for a moment lost sight of by those who administer the poor laws, are described at once the persons to whom, and the mode in which, parochial aid is to be given. The evils to rich and poor, but chiefly to the latter, which have arisen by deviating from this statute, are incalculable; and a steady but gradual return to its wholesome enactments seems the only way to avoid still more severe and extended calamities.

It appears that those to whom parochial aid is to be given are divided by the law into two classes, *viz.*, 1st, certain persons who are able to work, who are to be set to work; and 2ndly, the lame, &c., 'others being poor and not able to work,' who are to have necessary relief. The law has thus distinctly marked out two classes, and the different mode in which they are to be treated; and it is of the utmost consequence to the happiness and independence of the humbler ranks that the law should be followed up in practice.

We proceed to make a few remarks on the manner in which this statute should be executed, beginning with those last mentioned in the act, 'being poor and not able to work.' The persons enumerated are the 'lame, impotent, old, blind, and *such* other among them being poor and not able to work;' and in this class is comprised illegitimate orphans and deserted children, with the children, too young to be set to work, of impotent paupers maintained by the parish; to all these 'necessary relief is to be afforded; by which either pecuniary aid or other assistance, derived from 'competent sums of money raised,' appears to have been intended.

Some of the unfortunate persons belonging to this class may best be assisted by allowance from the poor rate, at their own houses, or whilst living with their relatives or friends; and there can be little doubt that, in some instances, this would be the cheaper plan for the parish, as well as most acceptable to the receivers. As, however, applications for such allowances are often unreasonable, and it is necessary for the parish officers to have a power of discriminating in the mode of support given, according to the character and conduct of applicants, it will be of the greatest consequence that they should be able to refuse giving any allowance in money; in which case they must have provided a poorhouse as a receptacle for the impotent poor, where they can be properly maintained.

It will be evident, also, that, besides those who *might* be supported by allowance elsewhere, there must be many, having no relatives or friends to receive them, for whom a home must be provided. These will generally be either the young children, or aged and infirm persons; and a moment's thought will be enough to show that, as far as possible, these should be kept separate. The aged inmates of a poorhouse are frequently of depraved and degraded dispositions; their minds are always soured with disappointment and regret; and they are, of all persons, those with whom young children, whom it is intended to bring up as decent members of society, ought not to associate.

One of the first things necessary in the due regulation of a poorhouse, will be a proper classification of its inmates; even the most infirm will be able to do some work, and as much work should be required from each as is consistent with health and comfort. For this purpose, by a little forethought, some employment may easily be provided. With constant

occupation, being treated with firmness, devoid of undue severity, even the most refractory may be governed without much difficulty. Humanity and good policy, enforced by the law, require that a difference should prevail in the mode of treating those who have been stricken by unmerited infirmity or calamity, from those whose misfortunes are the offspring of their idleness or intemperance.

At last, however, we must confess, it will be a hopeless task to reform, or even much to improve, the aged inmates of a poorhouse; and we must be content that it should remain a receptacle where the miserable are sheltered from starvation, and rescued from the temptations to crime arising from actual want. Its chief use will be to deter persons from having recourse to it, and to stimulate their industry and forethought to preserve their independence. For this essential purpose, a poorhouse ought not to have the appearance of being too comfortable; whatever regulations are laid down should be strictly adhered to; whilst necessaries are allowed, indulgences of all kinds should be curtailed; and such wholesome restraints kept up, as shall prevent any, who are without its walls, from relaxing their exertions to keep out.

With respect to the children, we may entertain very different hopes: they will probably grow up according to the training they receive; and if they have early had bad examples set before them, it is of still more consequence that they should be duly educated. This is of great consequence to the parish in a pecuniary as well as in a moral view. We all know that parish apprentices are now looked upon as great evils, instead of being sought after, as likely to become useful servants or assistants.

Nor is this without reason. Brought up, for the most part, amid vice and wretchedness, without the salutary controul of parents, and their education greatly neglected, it is not extraordinary they should frequently turn out idle and depraved, instead of becoming industrious and independent. They often entail cost upon the parish during their whole lives, and sometimes leave a legacy of miserable, diseased, and vicious children, to be supported after their deaths. Should they have obtained a settlement elsewhere, the evil is not less to the community, and each parish must bear its share in this partition of evil.

It is, therefore, a measure of *parish economy*, as well as of true humanity, to educate properly those deserted or destitute children who are cast upon the parish for support. For this purpose, they should be separated from any contact with the aged inmates of the poorhouse, and should at first be assembled in infant schools, where they will learn a little good, and avoid a great deal of evil, never to be afterwards eradicated. When old enough, they should be further instructed, at the parish expense, in what is fitting to make them useful members of society, until they are able to get their own living. It will seldom, indeed, happen in any parish, that there is not some benevolent person, either belonging to the select vestry, or known to the overseer, who will take pleasure in superintending, to a certain extent, the school for these poor orphans, and seeing that their education is not neglected. Though the names of such persons be unknown, and their acts unseen, they are fellow-workmen with the greatest and wisest of mankind, to improve the condition and increase the happiness of the human race.

Just in proportion as these parish children are properly educated or neglected, will be their chance of obtaining situations to earn their subsistence, and the probability of their keeping from being a future burthen to the parish. This important duty of overseers is, in many country dis-

tricts, totally neglected; the parish children are almost entirely uneducated. With bad examples before them, and no principles to guide them, they become hardened and depraved, and generally end their lives as paupers or criminals. Whoever considers this subject with the attention it deserves, will come to the conclusion, that one-twentieth the trouble and cost expended to repress and punish crimes, would, if early directed to improve and direct the ductile minds of children, have a much wider and more permanent effect. This subject has been well adverted to in the excellent Report of the Committee on the Poor Laws, in 1817, to which we shall hereafter advert.

We cannot refrain, before leaving this part of the subject, from insisting again on the necessity of *infant schools* for the very young: those admirable institutions have been found, in every instance, highly beneficial. The trifling cost, even in saving the clothes of the children and preserving their health, will be repaid. Let no one run away with the false notion, that these are schools for learning or places of confinement; they are places of exercise and amusement, where attention is easily awakened, where bad passions are corrected, and good feelings instilled. Whoever has seen one of these institutions properly conducted, and has witnessed the children coming voluntarily and cheerfully to its doors, will be quite undeceived in this respect. Such a school there ought to be in every populous parish; small ones might join together for this purpose. Wherever a large poorhouse, for the use of several parishes, is established, which in some districts is the case, an infant school should be an indispensable adjunct, from whence the inmates may be removed to one fitted for children of more mature age.

It has before been observed, that, independently of the necessity for a poorhouse to receive those paupers who are entirely destitute, it is of the greatest use to prevent imposition, more especially from idle or ill-disposed parishioners, resident in other and perhaps distant parishes. If, on their application for relief, an immediate offer is made to take them into the poorhouse, a great proportion will either decline the offer and shift for themselves, or very soon leave it after experiencing its regulations; so that the expense of the poorhouse is not to be measured alone by the cost of those *within* its walls, but its saving to the parish must be estimated by a fair consideration of the number of those whom it prevents from imposing on the funds for the poor *.

Having briefly considered the regulations and use of a poorhouse, for the purpose 'of giving necessary relief to the impotent, and others, being poor and not able to work,' it will be necessary to look to the other important directions of the statute which overseers are bound to follow, viz. 'setting to work the children of those who shall not, by the said overseers, be thought able to maintain their children, and for setting to work all such persons, married or unmarried, having no means to maintain them, and following no ordinary and daily trade of life to get their living by.' We may here borrow a little from the Report of a late Committee on the abuses of the poor laws†. 'Your Committee,' says this report, 'refrain from considering what was the meaning attached to the words of the

* By a steady adherence to this improved system under a Select Vestry, the following change took place in Liverpool, notwithstanding an increase in population of 10,000 persons.—1821, 4,717 paupers, cost 36,013*l.*: 1827, only 2607, cost 19,395*l.* —— *Ellis, Esq. Evidence before Poor Law Committee*, 1828.

† Report of Select Committee on that part of the poor law relating to the employment and payments of able-bodied persons from the poor rate, 1828.

statute when it was enacted, however interesting such an inquiry might be; but on this head, they venture to refer to the laborious and valuable investigation to be found in the report on the poor laws in 1817, and the report in 1819. It appears to your Committee, that under the construction now generally put upon these words, it has been held that all parishioners, not able to maintain themselves, have a right to employment by the parish.' It does not, however, appear, that justices have any power, under an order of relief, to enforce this supposed right of employment, which rests upon the discretion of each overseer, who is liable to punishment by law for abusing the power vested in him. 'Whether a man has no means to maintain himself,' and whether a parent 'can maintain his children,' appear to be 'questions letting in a wide discretion, on the part of overseers, as to the facility or difficulty with which they will comply with the requests of persons demanding parochial employment *.'

It would be irrelevant to our present purpose to show here, why it is advantageous to the poor themselves, that this discretionary power should often cast difficulties in the way of those calling upon parishes 'to effect the impracticable purpose of finding employment for all who may at any time require it.'

Whoever were the persons to whom the Act of Parliament extended, and with whatever discretion it may be exercised, one thing is clear, that the relief was to be afforded in one way, viz., '*by setting to work.*' It is, therefore, the first duty of those who have the execution of the poor laws entrusted to them, to provide the means of executing (when it is necessary) this important part of the law. It matters not to say 'the execution of the law is difficult,'—the more will it require our forethought and firmness to carry it into effect. But a little consideration will show us, that the difficulty is exaggerated, and will make apparent to us the numerous evils arising from neglect in the due execution of the law.

Those directed to be set to work are of two descriptions; first, children; second, persons having no means to maintain themselves, and using no ordinary and daily trade of life to get their living by.

'Though the persons entitled to relief, and the sort of relief, seem to be pointed out with sufficient clearness, yet the practice has, in many instances, long been at variance with the law. The statute directs the children to be set to work; the almost general practice is to give money to the parents, without setting the children to work.'

The able report, from whence we borrow this account †, goes on to point out the many evils arising from this deviation of the law, and the necessity of returning to the true system: an extract is there given from a Report of the Board of Trade on this subject, drawn up by the celebrated Mr. Locke in 1697, and well worthy our attention. In like manner, instead of providing employment for the other class to whom the law says it is to be given, money allowances are, in many instances, in the south of England, made instead. We will borrow the words of the Report of a late Committee on this subject. 'In some parishes, a weekly allowance is made to able-bodied labourers, without any employment being given; in others, they are put up to a kind of auction, as servants, to the best bidder, the difference between the amount paid and their sustenance being paid by the parish. The practice of allowance from the

* Report of Committee, 1828, p. 4.

† Report of Select Committee of House of Commons on the Poor Laws, p. 27, Oct. 1817.

poor rate for the children of labourers appears to prevail very generally in several of the southern counties subsequently named; nor is this at all confined to particular instances of distress from accidental circumstances, but it is adopted throughout large districts as a general rule, from which there is no departure, and to which, by custom, the married poor look as completely a matter of right. In some counties, it appears, the allowance for children is fixed and invariable, according to their number; and in others it is regulated by the price of bread, allowing a certain quantity per head for each member of a family. The Committee on Labourers' Wages, in 1824, lent close attention to this part of the subject; nor can your Committee do better than borrow their words.' After stating that in the northern parts of England these practices do not prevail, and that the wages there are good, they proceed to say, 'in Suffolk, Sussex, Bedfordshire, Bucks, Dorsetshire, and Wiltshire, the plan of paying wages out of the poor rate has been carried to the greatest extent. Norfolk, Huntingdonshire, and Devonshire are also afflicted with it.' 'Your committee,' (continues the report of 1828,) 'do not find reason to believe that any material improvement has taken place in the counties alluded to in this respect, and in parts of Kent, Hertfordshire, Hants, Surrey, Essex, Cambridgeshire, Middlesex, Berks, and Oxfordshire, the same system has been acted upon *.'

The consequences of the practice above described is stated in the former report in the following words:—'A surplus population is encouraged; men who receive but a small pittance know that they have only to marry, and that pittance will be augmented in proportion to the number of their children. Hence, the supply of labour is by no means regulated by the demand; and parishes are burdened with thirty, forty, or fifty labourers, for whom they can find no employment, and who serve to depress the condition of their fellow-labourers in the same parish.'

An intelligent witness, who was much in the habit of employing labourers, states, that when complaining of their allowance, they frequently say to him, 'we will marry, and you *must* maintain us!' 'By far the worst consequence of the system is' (adds the report), 'the degradation of the character of the labouring class †.'

In very many parts of the wide district to which the above extract applies, it is to be lamented that the magistrates (instead of endeavouring gradually to prevent these abuses, and to bring the practice of the law to what is warranted by the statute, and the example of the north) have been themselves the first to sanction and confirm these abuses. In some counties, the justices have adopted and enforced the worst form of deviation from the law, viz., a uniform scale of money allowance from the poor rate to every able-bodied labourer, graduated according to the number of his children and the price of bread. However benevolent the intention of the framers of such a scale might be, we cannot but consider it as a most mischievous invention, utterly subversive of the independence, industry, and happiness of the poorer classes.

It appears, also, that in many parts of the south of England, if the overseers or managers of the poor rate had any scruple (as, if ever they looked at the law, they might have had) in obeying the impolitic and ille-

* It will be seen, that all the districts in which riots have occurred amid the rural population, and where Special Commissions have, in consequence, been held, were named among these tainted counties. In Sussex, Wilts, and Bucks, the evil practice is perhaps most prevalent. The fires also have been almost confined to the counties mentioned in the text.

† Report, 1828, p. 6.

gal recommendations of the magistrates in this respect, by a forced and improper construction of a single ambiguous word in another part of the act, these scruples were effectually silenced.

On turning to that part of the statute which directs relief to be given to the lame and others, being poor and not able to work, and which empowers relief to be ordered by one magistrate, we find among those entitled to such relief, *the impotent;* and this has been frequently construed, throughout the southern counties, to extend to the young children of labourers or others, who are not thought by any magistrate able to maintain them; either from casual want of employment, the low rate of wages, or any other cause. We may remark, that these abuses appear to have had rise in mistaken benevolence during the high prices and rapid fluctuation in the value of bread from 1795 to 1815.

The pretence for any such practice is removed, but the evil arising from it is in full force. It cannot be necessary to enlarge upon the effects of these abuses, which are pointed out in the reports cited. It may be sufficient to say, that all the committees* who have considered the subject, and every writer, of the least authority, who has treated upon this matter for several years past, concur in deprecating the continuance and extension of the system.

Its effects are described as lessening forethought and industry, stimulating population where there is no adequate employment, depressing the *natural rate of wages*, and lessening the value of the poor man's sole possession, viz. his labour.

The Committee of 1828 state that, ' wherever the practices adverted to prevail, they have found there is a redundancy of labour, and that a proportion, varying from one-fifth to one-twelfth the number of able-bodied labourers belonging to the parish, are assisted by parish allowance or employment during several months of the year. The consequence of this redundancy is, that the wages are very low; as the labourers, exceeding in number the demand for their services, undersell each other in the market for employment; and being underpaid, become degraded, go to the parish-rate as a matter of course, and lose the hope of improving their condition by their own efforts.

' As, then, it appears,' says the Report, ' to your Committee, that the actual redundancy of labour is the principal source of the low wages and misery of the peasantry, it seems of consequence to consider whether that redundancy is kept up by anything in the practices alluded to?—because, if that *is* the case, it will follow that *low wages give rise to the practice of allowance, and the system of allowance reacts to keep wages low; so that, without some change in that which is alternately cause and effect, the evil may be continued in a vicious circle almost without limit.*

' In shortly stating the important principle which regulates the supply of labour, the Committee avail themselves of the words used in the Report on the Poor-Laws, in 1819, p. 7: " That the demand and supply of labour have, in the natural course of things, such a tendency to regulate and balance each other, (unless counteracted by artificial institutions,) that any excess of either arising from temporary causes, would, if met by temporary expedients, in no long time correct itself†." '

* Report on Poor Laws, 1817; Ditto ditto 1819; Ditto on Labourers' Wages, 1824; Reports on Emigration, 1826, 1827; Report on Criminal Commitments, 1827; Report on Abuses of Poor Law, 1828.

† Report, 1828.

We lament to say that these abuses of the poor laws, though chiefly prevalent in the southern counties before enumerated, are beginning to be introduced in some of the manufacturing districts. In the neighbourhood of Coventry it has made some progress among the silk weavers; and in the vicinity of Leicester many of the stocking weavers have had their wages made up from the poor rate*. Hence the returns and accounts of the sale of productions made by these workmen form no criteria of the real state of trade, which is kept up or extended at the expense of the rate-payers, who pay a portion of the miserable wages received by the men. Much better were it to slacken the supply of goods, till the demand rose to afford a just and honest remuneration for employment†.

It may not be improper to remark, even putting aside the injustice and impolicy of these practices, that, instead of really proving a saving to the employers, as they sometimes vainly suppose, by keeping wages low, these abuses cost, in the form of poor rate, and all the evils such a system engenders, much more than would pay the workmen ample wages ‡.

We will now turn to consider the means which should be taken in a parish where these abuses have some time prevailed, gradually to discontinue them. We must suppose that, in such a parish, there is a superabundance of labourers at one or other time of the year, beyond the employment for them at adequate subsistence wages. We will suppose this superabundance to be one-twentieth of the whole number. In either case, (that is, whether supported by parish work or parish allowance,) the cost will be nearly the same to the rate, but the effect to the men very different. If allowance be made from the rate in addition to wages, the whole number of men compete with each other for what work there is,—those assisted by the parish bounty underselling those without it, till the wages of the whole fall to such a point that all are obliged to have allowance, and all become reckless and careless as to their own exertions. If, however, the superabundant labourers be aided by employment found for them by the parish, they do not undersell the independent workmen, who are thereby enabled to earn adequate subsistence wages, and, being fairly paid, will exert themselves to maintain their independence.

Let us see then how, in such a parish, parochial employment may be provided, and what must be the nature of the employment.

i. We must try to create additional employment in a particular spot.

ii. It must interfere as little as possible with the ordinary work of the neighbourhood.

iii. It must in itself, or the mode in which it is recompensed, be rather distasteful to those who receive it§.

iv. It should be as much as possible of a temporary nature, and capable of increase or diminution, according to the exigency of the time.

* We feel convinced some mode of assisting working manufacturers, during temporary fluctuations in the demand for labour, must be devised; either by giving them facilities and inducements to insure themselves, or by providing employment at low wages ready for an emergency. Our poor laws afford little aid in this matter, and were enacted before the great bodies of men to whom we refer were in existence. Neither can we neglect this subject without danger to all around us.

† Report on Manufacturers' Employment, 1830.

‡ In some instances, the immediate effect may be to lower wages, and the tenant supposes he is hereby benefited, though at the expense of permanently raising the rates, which must ultimately be deducted from rent. If proprietors and agents have the least perception of their own interest, separate (if it ever can be separate) from that of the working classes, they will immediately check such an abuse.

§ Report on Labourers' Wages, p. 7. This excellent Report was drawn up by Lord J. Russell.

It is not necessary to echo the common statement, that we bave here a difficult task to perform.

The first thing to be done is to provide a workhouse, fitted for the reception of those who apply for employment and their families, and provided with adjacent work-yards for whatever work is in the particular vicinity found most eligible. To this may be added a small parish farm, which may be worked by spade busbandry. In the work-yards bricks and draining tiles may be made, stone or wood sawed, and other employments of a like nature carried on*. But it should never be supposed for an instant that any parish farm or fabric can pay for itself, much less make any profit. We must be content if, at an expense of one-third or one-balf the workman's subsistence, we can support him out of temptation to crime, without injuring the independent workmen of the parish, and yet give the parish labourer his subsistence in such a form as to incite others to avoid his situation, by forethought, diligence, and exertion.

It will be a main point to be able to lay down as a general rule, that whoever comes for parish employment, shall come to be at the workhouse altogether, and with their families sball reside there; when there, they will be supported and employed entirely by the parish. The importance and good effect of this regulation has been shown in numerous instances, as in Liverpool and many other places†.

It is not our intention to state that parochial employment should never be given to able-bodied persons, unless they become resident in the workhouse; but tbis ought to be the rule, and the parish work to out-dwellers the exception. By this means it will be in the power of the select vestry, or tbeir accountable officer, to act according to circumstances and the known character and conduct of the applicant; and this would go a great way towards deterring idle applicants and stimulating all workmen to industry and forethought. Another important advantage arising from this regulation will be, that it will draw a broad line of distinction, which should ever be preserved, between independent and parish workmen.

A benefit of as much consequence is, that this regulation will enable the managers of these workmen to find them in food, clothes, and other necessaries, instead of paying them money wages; hereby preventing waste, and at the same time putting single and married men (whose families will be supported in the house) on a level in this respect. If paid in money, the married man, under pretence that he must be paid according to the number of his family, will receive more than the single man, and often divert it to his own purposes, leaving his family to suffer; besides making tbe single man discontented, wbo will naturally (seeing be loses instead of gains by not marrying improvidently) resolve to marry without regard to consequences.

A portion, however, of the remuneration to parish workmen sbould be given or kept for them in money, according to the quantity of work they

* Mr. M'Adam, in his evidence before the Committee on Labourers' Wages, in 1824, stated that, under the improved system of road-making, the proportion of expense would be two-thirds for manual labour, one-third for cartage; whereas formerly those proportions were reversed. He says, a very fruitful source of employment might be found in parishes undertaking to supply the road trusts with materials prepared for repairs; and states, the work to be done is *chiefly in the winter and spring months*, and women and children may earn their share.—pp. 13—15.

† Report on Abuses of the Poor-Laws, 1828, Appendix; Evidence of Messrs. Hale, Ellis, Bucknall, &c.

do; hereby encouraging their exertions, and forming a small fund, by aid of which they may again emerge into independent work as soon as opportunity offers.

In order to carry these regulations into effect according to law, it will therefora be necessary for each parish, *where there are likely to be any number of applicants* for employment, to have a workhouse, and this they are empowered by law to provide if they are without. In some cases, however, and for small parishes, it will be a better plan to join (according to tha provisions of tha Act 9 Geo. I. c. 7.) with some adjacent parishes, for providing, by hiring or erecting, some suitable building as a joint workhouse, of which the cost shall be paid, however, *according to the number of inmates* sent by each parish each year; tha fixed axpenses of the establishment being paid by a proportion settled for each parish beforehand.

One of the most difficult parts of the duty of the permanent overseer or select vestry, will be to devise employment for parish workmen, consistent with the rules before stated; yet is it the most important. Above all, they must never bring the parish men into competition with independent workmen, so as to lower the wages of the latter; nor accept employment which would have been given to others in the neighbourhood. Yet there are, in almost every parish, or in every neighbourhood (for it by no means follows the work should be within the parish), various jobs of work in draining, clearing water-courses, filling up or emptying pits, cutting off angles of fields, removing banks, and other similar occupations, which it would answer well to the proprietor or tenant to have done at one-half or two-thirds the usual wages, but which he would nevar undertake unless induced by such an advantage. For such works the overseer may contract, receiving the price stipulated from tha proprietor amploying parish men, and paying them whatever is necessary. Here is so much new employment induced by the cheapness of labour; so far easing the parish rate, and not injuring independent workmen; for without such inducament it would not have existed; and yet, by its result, it contributes to the capital of the country, and the future additional employment of labour. Perhaps a good rule would be never to take any work of which the proprietor paid more than two-thirds the snbsistence wages; for otherwise ha might then, or soon after, have, perhaps, employed independent workmen himself.

Many landed proprietors, in such an emergency, on seeing the overseer zealously seeking out fresh employment, such as we have described, would coma forward to make some ornamental altaration in their grounds, to cut a private canal or piece of water, or in some way furnish new work; perceiving, as they would, that by as much as they thus gave towards the wages of labour, by so much did they relieve tha rates which were paid by themselves or their tenants; so that they would gain with ona hand as much as they would lose with the other; and this is an answer to what would otherwise be a good objection,—'That such proprietors, by withdrawing their expenditure in some other way to lay it out in such bribed or induced improvement, only take it from the support of independent mechanics or workmen elsewhere to assist parish workmen at home.'

A still more difficult case may arise, however, than that we have been considering. There are, unfortunately, parishes where the abuses described have prevailed for a very considerable time, where many have

married and brought up families, depending on this parish allowance for each child; and where, in consequence of this parish bounty thus illegally offered on improvident marriages, there is a large proportion of workmen for whom it is impracticable to find any independent employment in or near the parish. It is clear that it would be very harsh and unjust to condemn to residence in a workhouse those whom our own neglect and misconstruction of the law have placed in their present position; yet as long as they remain in the parish without additional employment, they must compete with and undersell all the other workmen, who would otherwise be enabled to gain enough to maintain their families independently. With regard to new applicants for parish assistance, there will be no injustice in giving notice (and this should be enforced by a declaratory Act of Parliament) that, *for the future*, the law will be adhered to*, and that parish assistance will alone be given in the form and mode described by the statute, and as administered in the northern parts of England.

What are we then to do with the labourers, redundant as regards that particular parish, for whom we are bound, if not by law, yet by justice (owing to our own neglect) to find comfortable employment.

It will be the cheapest, and the most just and politic way, to face the difficulty at once. We will suppose, in the parish in question, there are one hundred labourers, and one-tenth (ten) are without independent employment, unless by competing with the other ninety, some or all of whom will become partially dependent on the parish.

These ten men, we will suppose, will, with their families, require each 10*s*. per week for their support, that is in all 260*l*. per annum. This, therefore, will be their expense, supported by the parish either in idleness, or partial work *taken from the other workmen*. This 260*l*. will be to be borne by the parish during the lives of these ten labourers, and of such of their families as would stand in their places.

How then can we best provide for these men, whom we must somehow support? It is evident we must either remove them to some other place, where labour is not redundant, and where the value of their work may support them, or we must in some way create additional employment within their reach at home. We will first consider the latter alternative, as the most easy of execution, and practicable with little or no change in the law as it stands †.

The plan we propose is, for the parish or individual proprietors (led, as we shall see, by interest as much as humanity) to offer to the unemployed labourers for a term of years, at a low fixed rent, such a portion of land, to be worked principally by spade husbandry, as shall be sufficient for the support of their families. (Let not our readers exclaim impatiently against us, but follow out the considerations we lay before them.) We suppose this quantity to be on an average about six acres, (but this will be regulated by the quality of the land, size of the family, &c.) It will be necessary to erect on these spade farms such small buildings or sheds as may be necessary for their cultivation; by the plots being adjacent to each

* This may be done even without a declaratory Act, by the justices at sessions resolving and stating publicly their resolution to adhere to the law, as acted on for the most part in the north; but, at the same time, the most strenuous and extensive exertions must be made for the employment of those aided from the parish during the transition to a better system.

† Voluntary emigration, properly conducted, may, in some cases, be preferable; but requires details beyond what our limits will allow.

other, one small barn centrally situated, to be used in a certain rotation by each, may serve several workmen. A stipulation must be made in the leases, that there shall be *no division or under-letting*, and that no such labourer *shall work for any one but himself, except in the harvest month.* A sufficient outfit in stock, seeds, tools, &c., must be found for those in want of them to begin with.

Each unemployed labourer would thus be changed into an employed workman supporting himself, or into a spade farmer working his own land, on an assurance that, *according to his industry* and care, would be his gains and the condition of his family; and thus the strongest motives, which have been found effectual in all other conditions, would be brought to bear on his mind. As he found his state improve and hope broke upon him, his efforts would be redoubled to maintain his place.

Let any one compare the produce of six acres trenched, pulverised, and worked like a garden, with the produce of the same land comparatively neglected. This subject has been considered by many intelligent practical men; and though some were at first distrustful of our calculations, on examination they have almost universally become convinced we were right*. We do not say there are not difficulties to be overcome; but they are not insuperable; we have but a choice of difficulties, and the advantages to be derived from success in such an experiment are incalculable.

In the agricultural operations necessary to be carried on in a spade farm, there will be occupation for the workman's wife and children; the latter will thus early be brought up in habits of industry and obedience: the great difficulty will be to prevent the exhaustion of the land by over-cropping; but this may be avoided by judicious regulations as to rotation of crops, and a well-considered plan for keeping up a stock of manure†. When this is once thoroughly understood by the working tenant, he will be convinced it is his *own* interest to follow it; and there is no bond like self-interest.

In many well-cultivated cottage gardens, wheat and potatoes succeed each other as crops for many years; such a course would be very injurious in ordinary husbandry; but the exhaustion of the land is compensated by extra manure, and the more perfect working of the soil by hand labour. It is well known that in dry weather turning up and stirring the earth in drills refreshes the crops almost as much as rain.

By keeping pigs, or perhaps a cow (tied up in a shed and soiled as on the continent), every bit of refuse may be consumed on the premises, and much manure be returned to the land.

Every agriculturist, acquainted with the fertility arising from the pulverisation and frequent stirring of the earth, as detailed by the best writers on husbandry, will allow our expectations are not over-sanguine.

The occasional hire of a horse and cart, to bring home the crop or to fetch a load of lime, may sometimes be wanted; the rest will be done by hand or with a barrow.

The experiment of these spade farms has been made on a sterile soil in Holland with great success, and we refer with pleasure to the accounts and details of those trials. The cost of the necessary outfit may be raised from the parish rate, in order 'to set the poor to work;' and by the

* Lord Braybrooke's account of the success of some spade farms in Essex.

† In the account of the poor colonies of Holland are some valuable accounts of the mode of economising and increasing the value of agricultural manure.

59 Geo. III. c. 12 the parish is empowered to rent twenty acres for the same purpose.* But we feel convinced that many land-owners, when once this plan had been fairly tried, would themselves commence such spade farms, where there were redundant labourers, both from motives of humanity and policy. It has been said, on the one hand, that labourers will be so fond of having an independent bit of land in their own management that the best labourers would be desirous of becoming such tenants; this would very probably be the case. In consequence, they would want less outfit, and the benefit would be the same to the community, as thereby a number of workmen equal to those unemployed would be taken out of the labour market, and the wages of the rest would rise so as to maintain them in independence. Supposing, however, instead of earning on their spade farms *quite* enough for the maintenance of their families, as we believe they would,—supposing, for instance, 26*l.* per annum being necessary, they only earned 20*l.*, what would be the consequence?—that the parish, or their landlord, by means of a gift of coal, corn, seed, or some indirect assistance, should make up the difference until they were able to walk alone. In the interval, the parish will have gained all that they save by the man's own gains, for before, they had to support him entirely; the condition of all the other workmen will be improved by the removal of his competition for their employment, and the man himself, fully and beneficially occupied, will be contented, because he has a fair prospect of improving his condition, and knows the fruits of his industry will be his own.† If on a farm of 100 acres, under the common system, two labourers are constantly employed through the year, the same land divided into spade farms as proposed would find occupation for sixteen, and supersede there, in great measure, the use of horse labour.

These benefits are not to be gained without pains and perseverance; but the experiment is absolutely necessary, and will well repay any benevolent proprietor or rate-payer the trouble necessary to attain success. It must be gratifying to think that, instead of being unpopular among the poor, they would be eager and grateful to embrace the proposition made them;—the regulations necessary must be well considered, and firmly adhered to, especially that of each man being *constantly employed on* his own land.

Let it be remembered, at last, that this plan ‡ is not recommended for general or permanent adoption, but only as a *temporary* means of lessen-

* By a late act extended to fifty acres.

† We may add, that if, under the proposed plan (which would at least be popular with the peasantry), we had to pay the *whole* of the cost of their subsistence (26*l.* per annum each), it would still be much more to our interest than to continue the allowance system, because, in the latter case, the cost is *perennial*, in the former, it ends with the lives of the annuitants.

‡ We will mention two plans for the assisting of agricultural labourers, not directly connected with the subject before us; but will yet, we hope, be useful, and may either of them be carried into effect by benevolent landholders. The first in action in several places, is very simple. The landlord, or a society raising the funds by subscription, offer to any labourer who will lay by sixpence, or any smaller sum, per week, to add to it half the amount at the end of the year, and lay out the whole in some useful thing to be given to the contributor. This has been found popular among the peasantry, and might, with some changes, be adapted to towns also. The second is general in several parts of Holland, and consists of an insurance office on a simple principle, established and guaranteed by the local authorities and persons of property, in which workmen and labourers, by paying a small sum, can insure, in case of death, a provision for their widow and for each child, till old enough to support himself. In one part of Holland we were told the female peasantry used to consider this right of dower as greatly favourable to the claims of any suitor.

ing a great existing evil DURING A TRANSITION from a bad administration of the poor laws to an improved system! It is essentially different from any plan of dividing farms into various cottage holdings, and building *new* dwellings therein, which would only stimulate population, increase the number of labourers in a particular district, already too full, and thereby eventually much augment instead of diminish the evil complained of.

March, 1832.

ABSTRACT OF PAROCHIAL EXPENDITURE.

Parish of

	183	18 Past Year	More.	Less.	Cause of Difference
Poor's Rate in Year . .					
Rate in Pound in Year . .					
Rate in Pound on Rack Rent .					
Highway Rate . .					
EXPENDITURE OF POOR RATES.					
County Rate . .					
1 { Infirm and Poor .					
In-Poor—Cost . . Number . .					
Out-Poor—Cost . Number . .					
Illegitimate and Orphan Children } Cost No.					
2 Able Bodied—Cost . and Number .					
By Work . . If otherwise, How ?					
Casual Poor . .					
Law Expenses . . Salaries . .					
Repairs, Rent, Stock, &c. . .					
Population from Returns . .	1821	1831			
General Observations on State of Poor, &c.					

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FARMER'S SERIES.

THE COTTAGER'S MANUAL

OF

HUSBANDRY, ARCHITECTURE, DOMESTIC ECONOMY, AND GARDENING;

ORIGINALLY PUBLISHED IN THE GARDENER'S MAGAZINE.

BY J. C. LOUDON, F. L. S., H. S., &c.,

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THE COTTAGER'S MANUAL.

Chapter I.

COTTAGE HUSBANDRY.

Without discussing the question of the quantity of land which it is expedient to attach to every cottage, we shall begin by assuming that no cottage ought to be built without some land beiug attached to it; and the following are our reasons:—

1. Every cottager requires for the use of his family a certain quantity of vegetables and fuel.

2. Every labourer, mechanic, operative manufacturer or small tradesman has, or ought to have some hours of leisure every day, for the purpose of health, recreation and enjoyment.

3. Recreation is not idleness, but a change in the kind and degree of labour or occupation.

4. The raising or culture of all his vegetables, including potatoes for his family, and for one or two pigs, poultry, &c., and fuel, may be made the recreation of the cottager and his family, without infringing one hour on the time allotted to his business.

5. Vegetables so raised will cost the cottager less than they could be produced for by those who raise them as a matter of businesa and not of recreation.

6. The sense of property, the possession of a comfortable home, and the social affections and local attachments thereby produced, will greatly increase the enjoyments of the cottager, and in every way render him a better member of society.

These reasons are unexceptionable in point of theory, and confirmed by experience and observation, not only of this particular country, but of one country as compared with another. Compare Tuscany, Switzerland, and Bavaria, with any part of Great Britain. In all the reports that have been published respecting the poor and the poor's rate in England, it will be found that those were always the last to seek relief from the parish who occupied land. If the case of the cottagers of Ireland should be brought forward to show that a cottager may occupy land, and even possess a cow, and yet be very miserable, we reply, that the land of the cottager in Ireland constitutes his business, that is, his main source of existence; whereas we propose that only such men as have and follow some regular business as a means of existence, such men in short as are required by the existing demand for labour, should have a cottage and garden, and that they should depend on the latter for such a part only of their means of subsistence as theycan procure during their hours of leisure.

As what we recommend, therefore, cannot he considered as forcing the cottage system, we do not think it liable to the reprehension of those who maintain that, by adding to the comforts of the poor, we are only preparing for their future misery by facilitating their increase. The more a man's

enjoyments are increased and his character raised, the less likely will he be to risk the diminution of these enjoyments, and the loss of respect among his equals, by an early or rash marriage, and by the creation of offspring without regard to what is to become of them. It is always the most destitute who marry first; because, when the degree of suffering is at the extreme point, any change is sought for relief. The possession of comfort is by far the best security for the prudent conduct, not only of the poor, but even of those who are better off; and for the rising generation, our safeguard is the study of their comfort, joined to a wisely-contrived system of national education.

The necessity of attaching land to all cottages being granted, we shall next endeavour to ascertain what quantity ought to be attached. For this purpose we shall first enumerate the different objects to which the land may be applied; and we think these, for the dependent or labouring cottager, may be reduced to the first four following; and for the independent or proprietor cottager, to the succeeding three:—

1. To supply the cottager's family, including pigs and poultry, with vegetables and potatoes.

2. To supply the cottager's family, including pigs and poultry, with vegetables, potatoes, and faggots for his oven.

3. With vegetables, potatoes, fuel, and barley for his malt.

4. With vegetables, potatoes, fuel, barley for his malt, and the keep of a cow.

5. With vegetables, potatoes, fuel, barley for his malt, the keep of a cow, and bread corn.

6. With vegetables, malt, a cow, bread-corn, and mangold wurzel for his sugar and spirits; fruit-trees and vines for his cider, perry, and wine; tea and coffee, or substitutes for these articles; tobacco, opium, and the ordinary family medicines.

On the last two objects we shall for the present say little, as they are not so applicable to this country as to other countries less advanced in the division of labour; and especially as they would entail on the cottager labour which might interfere with his regular employment, instead of recreative labour to be performed in his mornings and evenings. The first four objects may all be attained by the labour of any able-bodied man, with the occasional assistance of his wife and children, in hours which would be otherwise spent unproductively, and listlessly, or perhaps viciously.

1. For the first object it seems to be allowed by almost all the writers on the cottage system that one rood is the average quantity that will suffice. It has been argued that less will do; but this proceeds on the supposition that every process succeeds and produces a full crop, which is never the case in even the best-cultivated gardens. There may be cases, however, as in those of yearly farm-servants, in which the potatoes are grown by the farmer, and in that case the quantity of land may be reduced, we think, one-half, *i.e.* to 20 rods.

2. For the second object, that is, the whole or a part of the fuel required in addition to vegetables, the quantity will vary considerably, according to the part of the country where the cottage may be situated. More fuel will be wanted in the northern than in the southern parts of the island; and in districts where coal is so cheap that fuel for a year may be purchased for the rent of an ordinary acre of land, we should propose that the cottager raise only fuel for his oven or stove.

To raise the whole of the fuel for a cottage of the lowest class will require 1 acre of middling land. To raise faggots sufficient to heat the

oven or stove, say 170 times a year, will require about three-fourths of an acre; and hence we may conclude 1 acre to be the smallest, and 1¼ acre the largest quantity, for this class of cottages. The data on which these quantities are founded will be afterwards given.

3. The third object, which to vegetables and fuel adds barley for malt, requires a rood more than the second object, or from 1¼ acre to 1½ acre.

4. For the fourth object, which includes vegetables, the whole of the fuel, barley for malt, and the keep of a cow, the quantity will vary according to the quality of the soil, the climate, and the circumstance of its being under the plough or in pasture; because, though in the latter case he will not derive so much produce from a given surface, what he does obtain will be got with less labour. In Rutland it has been found by Lord Brownlow and others that 2½ acres were sufficient to keep a cow a year; and that there, where every cottager has a cow, from that quantity to 3 acres was invariably allowed. Probably, at an average of the country, 3 acres may be requisite; and this, with one acre for fuel, a rood for malt, and a rood for a garden, will give 4½ acres for the maximum quantity of land for this class; or, if only part of the fuel is to be grown, 4¼ acres.

5. The fifth object, to vegetables, fuel, malt, and the keep of a cow, adds the requisite quantity of bread-corn. John Denson says, "He could mention several labourers that have brought up their families and paid their way entirely on the produce of 2 or 3 acres of land:" (*A Peasant's Voice*, p. 12.) and we do not doubt it; because, in that case, his whole labour being bestowed on the land, it would be cultivated to the utmost, and probably a part of the produce of the garden sold at good prices.* The same practical writer is "convinced that a sober active man would keep a cow, a breeding sow, a good fat hog in the sty, and grow plenty of corn and vegetables for the consumption of his family, and pay rent, rates, and taxes, from the produce of 3 acres of land." (*A Peasant's Voice*, p. 27.) If we add, in countries where fuel costs more than the rent of an acre of land, an additional acre for wood, and a quarter of an acre for malt, this will give 4¼ acres; but we should say, for the average of soils and situations, 5 acres. It is obvious that this quantity of ground could not be cultivated by a labourer at his leisure hours; nevertheless, if we suppose one acre devoted to wood, another to permanent pasture, and that the remaining 3 acres are in part worked by the hired labour of a steam or horse plough, we shall find that the labourer would still have a good many weeks' labour, in the course of the year to dispose of to others.

6. Vegetables, malt, a cow, bread-corn, sugar, spirits, cider, perry, wines, tobacco, substitutes for tea and coffee, opium, and the ordinary family medicines, might easily be obtained by an additional half acre. From a portion of mangold wurzel as much sugar as would supply the family could easily be abstracted, and the rest of the roots and the refuse of the sugar manufacture given to the cow. A part of the sugar in its first, or molasses, state might be fermented and distilled, so as to produce a good spirit; and another part fermented with yeast and hops, or the substitutes for hops, so as to make a very good beer. Where bees can be kept, sugar, beer, wine and spirits can be prepared from their honey, and candles from their wax. The cider and perry might be obtained from standard fruit-trees in the ring-fence of the premises, or from standards thinly scattered throughout the whole 5½ acres. The wine might be made from gooseberries, cur-

* See likewise the treatise on Flemish Husbandry in the Farmer's Series, ch. xvi., p. 70—82. "Of the Spade Husbandry practised in the Small Farms in Flanders."

rants, elder berries, and other fruits, and from the grapes of a vine made to cover the whole of the house and offices. Coffee might be obtained from chiccory or dandelion roots, or from the seeds of the Astragalus bœ'ticus, which is extensively grown for that purpose in Hungary and Bavaria; and tea (though not so good an imitation as the substitute for coffee) from the dried leaves and flowers of different species of *Verónica*, from the leaves of Dryas octopétala as in Sweden, of Rùbus árcticus as in Norway, of Saxífraga crassifòlia as in Siberia, of Prùnus spinòsa and àvium, and of the leaves of the common sweet briar, as in different parts of Europe. The dried leaves of the common black currant afford a substitute for green tea, which very few can detect; and perhaps these leaves, and those of the common sloe, or plum, in the proportion of one-fifth of the former and four-fifths of the latter, form as good an imitation of the tea generally used by cottagers as can be obtained. Every cottager may distil a coarse brandy from gooseberry or other wines, and whisky from wort of malt, or from beet-root molasses; and he may give the former the flavour of noyau with the kernels of cherries or with a few peach leaves, and the latter the flavour of gin with juniper berries.

We shall now give our reasons for proposing that every cottager (not living in a coal or peat district) shall raise a part, or the whole, of his own fuel. Every person who lives in the country, or even looks at a newspaper, is aware that the sufferings of the poor from cold, during the winter season, are fully as great as from want of food; and that pilfering from woods, hedges, or fences, is one of the commonest offences. In former times the cottager's fuel was obtained from the bushes which grew upon the commons and waste lands, or, if he was a copyhold tenant, from the lord's woods; but now the poor man must buy fuel. This he can do in the coal districts, or in those where turf is used as fuel, or where wood is very abundant: but these districts are few; and in by far the greater number the labourer of necessity procures his fuel by pulling the hedges, cutting here and there a branch of such trees as come in his way, breaking gates and other wooden fences, or perhaps from the coal heaps or faggot stacks of his richer neighbours.

Where there are children, the task of catering for firewood is generally committed to them. The mother sends them out as soon as they can walk, to bring in sticks; and they may be seen gathering them in the nearest plantations or woods, and pulling them from the hedges along the roads and lanes; in short, wherever they can get them. The evil results of this habit upon the infant mind are obvious; the endeavours at concealment lead to lying, and to dread and hatred towards all those who have anything that can be stolen. But all the fuel that a labourer can procure in this way is still insufficient for his purposes, and he is only kept from absolute starvation by a parochial supply, or charitable contributions. If, therefore, the labourer could be rendered as independent in his fuel, as he frequently is, and in all cases might very easily be, in his potatoes and vegetables, his comforts would be greatly increased, his moral character raised, and the parish and his neighbours who have property would in every way be gainers.

We shall first endeavour to show the proper use and economy of fuel, and in what manner common faggot wood, or the spray and shoots of ligneous plants of three or four years' growth, may be rendered as effective as billet wood, or mineral coal, both in warming the air of a house, and in the operation of cooking. By the use of mineral coal, both these objects may be effected by means of our common open fire-places; but it would not be

easy to maintain this temperature by burning spray or faggot wood in the same manner; not from any deficiency in the heat produced, but from the rapidity of combustion, by which great part of the heat is carried directly up the chimney, and such a current of air produced there, that after the flames of the spray have subsided, the draft is continued by the heated sides of the chimney, and thus the warm air of the apartment is rapidly exhausted to supply the current. The place of the warm air in the apartment is as readily occupied by cold air, and the room, which ten minutes before was very hot, is now very cold. A second fire of spray is immediately required, to be attended in its turn by the same results. The same effects, but in a less degree, are produced by fires of billet-wood roots, or in fact any description of wood. There is one reason for this which deserves to be mentioned, because it is not very obvious to those who are accustomed to coal fires. Wood fires, and especially the non-resinous kinds, produce very little soot, and scarcely ever a soot which adheres to the chimney. The sides of the chimney being therefore free from what every body knows to be a powerful non-conductor, a coat of soot, they become rapidly and powerfully heated, which consequently accelerates the current of air, and continues this current at a rapid rate much longer after the fire has gone out than in the case of a chimney where the fuel is coal. It is clear, therefore, that wood is not a proper fuel for the description of fire-places in use in this country. Burnt in the centre of an immense hall, and its smoke allowed to fill the upper part of this apartment, as in former times, or in logs or thick chumps on the ground, as in the wide open fire-places of America, it is more effective; but in small raised fire-places, with narrow chimneys, it is very inadequate.

On the Continent, where the fuel is almost everywhere wood, and where, from the greater severity of the winter, greater attention is required to heating apartments, the air is warmed and cookery effected by distinct processes. The air of the room is warmed by burning small wood, spray, faggots, or wood of any sort, in a stove, and cooking is performed on raised hearths by charred wood, or on low hearths by chump-wood. Something of the same kind is what we propose to introduce into the cottage system of this country. Heating we would effect by flues in the floor of the kitchen or living room, when that floor was on the ground, and could be composed of vertical strata of gravel or small stones alternating with smoke-flues, the whole being covered with tiles or broad pavement. But when the kitchen or room to be heated is so situated, that the flues could not be made in the floor, we would effect heating by a very simple stove composed of common bricks and paving tiles, and occupying the whole, or a part of one side of the room. This side should always be one of the inner sides in cottages already built, and in cottages to be built, the stove may in almost every case be made to serve as a partition wall. Cooking we would effect in open fire-places as at present, and either with large wood, that is, pieces of 2 in. and 3 in. diameter, or with the half-charred fagot wood that is produced in stove fires when the furnace and ash-pit door are closed before combustion is completed. Whoever has seen the heating and the cooking of the Continent will allow that the methods we have proposed would completely attain the ends in view, and, to all who could not purchase coal, be a great improvement in the economy of fuel.

Having shown how we propose to apply fagot wood to the purposes of heating and cooking, we shall next endeavour to show that one acre of land of middling quality will produce enough of this wood for an ordinary cottager.

In order to ascertain what quantity of ground will grow a fagot, we shall consider a fagot to consist of eighty black Italian or Lombardy poplars, or Huntingdon willows, of three years' growth. These we shall suppose to be grown in rows, 2 ft. apart, and the plants 6 in. distant in the row. At this rate every plant will occupy a square foot, and as there are 43,560 ft. in an acre, that space will consequently produce 544 fagots every third year, or every year 181 fagots of three years' growth, which are thirteen more than will be wanted for the purposes of baking and warming throughout the year. Now these 13 fagots being composed of 1040 shoots, say only 1000, suppose them to be distributed at equal distances throughout the acre, and allowed to attain five years' growth instead of three, this will give 200 trees a year, three-fourths of the length of which will cut up into bundles of billet wood from 2 in. to 5 in. in diameter for cooking on the open fire; and the side spray, and the remaining third part of the stem, may be made into fagots, to make good the requisite number for the oven, or to compensate the injury which these 1000 larger trees may do to the 33,560 among which they are placed: this calculation we think is sufficient to show that an acre of wood applied to cottages on our construction, and probably even to those on the ordinary plan, will supply fuel for every year. We are confirmed in this calculation by several experienced gardeners whom we have consulted on the subject. When a plantation is once established, perhaps the simplest mode of management will be, to fell a fifth part every year, separating the larger wood for the open fires, and fagoting up the smaller for the oven.

When a part of the fuel can be purchased, say coal or turf for the open fires, half an acre might probably be found sufficient for the oven, more especially if the garden were surrounded by a hedge in which were a few poplars, and the interior contained a few standard fruit trees. The prunings from all of these, and the occasional cutting down of a poplar, would become effective to a certain extent both in the oven or stove for heating, and in the open fire-place. John Denson says, "that the haulm of half an acre of potatoes will serve for heating a cottager's oven;" but we would rather litter the pig with the haulm, and no doubt he would agree with us in opinion had he fuel otherwise provided.

Whatever quantity of ground is allotted should be trenched 3 ft. deep at least; but, if the soil is dry, it may be trenched 5 ft., not casting the top in the bottom, but mixing them together. (*Encyc. of Gard.*, § 1870.) A plantation so formed would give a produce very superior to that of common native copse, where the soil has never been touched; it would continue improving for many years, and when it began to be less productive, might be trenched over at the rate of one division a year, and replanted with trees of a different natural order. The locust, the ash, or the bird-cherry might succeed the poplar or willow families. According to Marcus Bull, the ash is one of the most valuable of woods as fuel; the birch is also very valuable; the wild cherry (Cérasus virginiàna) is to the ash as 55 is to 77; the Lombardy poplar as 40 to 77. (*Experiments to determine the comparative Value of Fuel, &c.*, Philadelphia, 8vo, 1827.) The site of the copse might, after a certain period, be changed, and the ground cropped for another series of years with kitchen-vegetables and potatoes. The rooting up and replanting would of course not take place with the whole quantity at once, but only with a fifth part at a time, which would equalise the labour, and enable the cottager to effect it with ease at his leisure hours. The cutting over should be done in the autumn, or beginning of winter, and the carrying home and fagoting,

or otherwise preparing for the fire-place and oven, may take place in dry weather during winter, as opportunity offers. In thin barren soils a larger quantity of ground than an acre may be required, and it may be advisable to plant the Scotch pine or larch, or birch, or possibly even furze or elder; but we do not believe there is either a soil or a situation in Britain where 2 acres, properly planted and managed, would not produce all the fuel which a cottage would require, if it were economised in the manner we have described.

An acre of land of average quality being thus estimated as sufficient to produce the whole of the fuel required by a common cottager, we think that in all those parts of the country where the fuel a cottager requires would cost a sum equal to the rent of such acre, it would be his interest to pay that sum for the use of an acre. As he could receive nothing from this acre for four or five years, and must bestow a great deal of labour in trenching it, and procuring and planting the sets or trees, he ought to have it for at least ten years without rent. But, in consideration of this, he ought to be held bound to trench and plant it in a proper manner, to cut it down in regular portions, and to leave it in a proper state, and fit for the immediate use of his successor.

Malt.—To grow his own malt would perhaps be of no great advantage to a cottager in this country, and at the present time; but where an opportunity offers, it may be well for him to know how easily it can be done. The average produce of a rood of barley may be taken at 20 bushels, which properly malted will produce 25 bushels of malt, and this brewed will produce, according to Cobbett, 450 gallons of good beer. But, as Cobbett only allows a labourer's family 274 gallons a year; viz. 2 quarts every day from the 1st of October to the 1st of March inclusive, 3 quarts a day during the months of April and May, 4 quarts a day during the months of June and September, and 5 quarts a day during the months of July and August, and as this quantity of 274 gallons can be produced by 15 bushels of malt, or 12 bushels of raw barley; a rood of a fair crop will give the beer requisite, and 8 bushels of barley more for the pigs and poultry, for distilling a little whisky, or for husking as pot-barley.

Pot Barley.—The husking can only be well done at a barley-mill; but, by steeping the barley for six hours, and then kiln-drying it, or drying it on the flued floor, or on the stove, or in the oven, the husks will come off in a common corn-mill, or by rubbing in a mortar with a pestle. The garden and also the field pea are steeped and husked in this manner for split peas and pea meal; but the pea is not, in general, a profitable crop for the cottager.

Malting is nothing more than an artificial mode of making the barley vegetate, by steeping it in water, and fermenting it afterwards in a heap, to produce heat enough for germination; and then stopping its progress towards forming a plant, by kiln-drying. The cottager may put the quantity of barley which he intends to brew in a bag, and steep it in a tub of water for an hour; then take it out, lay it in a heap on the floor of a warm place, and cover it over with straw, or with two or three bags, to produce a moist heat, and bring on vegetation: when the radical is three fourths of an inch long, he may spread it out and dry it, either on the hottest part of his flued floor, or on his heating flue, or in his oven. But, according to some, very good ale may be produced by grinding or bruising unmalted barley, and mixing it with a small quantity of ground malt, leaving it in mash at a heat of about 150° for two or three hours. The malt is introduced to hasten the fermentation of the bruised grain, which is said to be as complete as if it had lain a

fortnight on the malting-floor. Cobbett disapproves of this mode of making beer, which, he says, produces strength; but a flat beer, that lies heavy on the stomach, has a bad taste, and is unwholesome, and therefore we do not recommend it, unless in cases of necessity. Perhaps sweet beer, such as is easily made from honey, treacle, or beet-root molasses, might be preferable. As unripe potatoes, and the point or least matured end of ripe potatoes, are found to vegetate soonest, so unripe seeds of every sort are also found to vegetate soonest: therefore, that part of a cottager's plot of barley which he intends for malt, should be cut a few days sooner than the remaining part which he intends for pot-barley meal, or feeding his pig.

It is a very common practice in several parts of England, when wheat, barley, or other grain is sprouted in the ear, in consequence of a wet harvest, to carry home these ears, dry them, and use them as malt. The seeds of ryegrass, if sprouted, we have no doubt, would make very good malt.*

Hops.—Nothing can be easier than for every cottager to grow his own hops. He may either plant a single hill, as the term is, of four plants on a surface of a square yard, to run up four poles 12 or 15 ft. high; or he may plant five or six roots round an arbour; or, if his cottage has a rustic veranda, a plant may run up each column. As a substitute for hops, the marsh trefoil (Menyánthes trifoliàta) is employed on the Continent; and, it is said, was formerly used in this country. One ounce of the dried leaves is said to be equivalent to half a pound of hops. The plant is of easy culture in moist soil. All the plants of the same natural order, Gentiàneæ, and especially the different species of Gentiàna, might be used in the same manner, more particularly G. lùtea, rùbra, and pùrpurea. In Switzerland, a spirit is distilled from the roots of G. lùtea. The dried roots of Gèum urbànum, common in hedges, are sliced, enclosed in a thin linen bag, and suspended in the beer cask, by the brewers of Germany, to prevent, it is said, the beer from turning sour, and to give it the odour of cloves. There can be little doubt that several other plants belonging to the Rosaceous tribe Dryàdeæ would have a similar effect: such, for example, as Agrimónia, a most fragrant bitter, and Dryas, Cômarum, Potentílla, and Turmentílla, powerful astringents. A similar use is made of the roots of 'Acorus Cálamus and ginger, the seeds of coriander and carraway, and the skins of oranges and capsicum.

Sugar.—The idea of every cottager growing his own sugar is, perhaps, of still less value than the preceding one respecting malt; nevertheless, in the interior of Germany and America it may be desirable sometimes to have home-made sugar; and therefore, we shall here state that the produce in France of a ton of mangold wurzel is a cwt. of sugar; and, as half a rood will grow at least 3 tons, here are resources of 3 cwt.; or say only half that quantity, which is as much as any cottager will use in a year. The pulp of the root, after the juice is pressed out is found in France to fatten at the rate of a bullock an acre: and hence the pulp of half a rood will be of no small value for the cottager's cow and his hog-tubs. The following process for manufacturing beet-root sugar, most suitable for the cottager, has been kindly furnished to us by Mr. S. Taylor.

* There is a mode of making beer from sugar described in the *Cabinet Cyclopædia*, vol. iii. Domestic Economy, p. 207, which is almost as easy as making tea. The flavour, the writer says, is superior to that from malt; and its tightness on the stomach places it above all competition.

Sugar from Mangold Wurzel.—"Dear Sir, I believe you are aware that the manufacture of sugar from the beet root or mangold wurzel is more likely to succeed on a large than on a small scale. Still I see no reason why, because we cannot do all we *wish*, we should not do all we *can*.

"The quantity of land required to produce 1 cwt. of brown sugar will, of course, in some degree depend on the quality of that land, and its state of fertility, natural and artificial. On this I have a word to say. The occupier of a poor hungry soil may fancy that he has but to apply an additional portion of good rich manure to obtain as great a weight of root as his more fortunate neighbour on a kind deep loam; but assuredly he will find himself in error. As great a *weight* of root I think it is likely he might get; that is no hard matter to effect by dint of artificial means: but the question is, what would be the probable amount of sugar from roots so obtained? You will not be surprised to hear that the weight of roots may be doubled; and yet not only shall the weight of sugar not be doubled, but it shall even be diminished. We grow enormous crops of mangold wurzel near London; but they are unfit for the purposes of sugar-making, and the reason is obvious: the weight is made up of aqueous, not saccharine, matter. I say this to caution the occupiers of small patches of ground against the practice of over-manuring. The French crops do not average 15 tons an acre of root: this is, undoubtedly, a lower rate of produce than even, for sugar-making, they might safely resort to: 20 and 25 tons might and ought to be raised on an acre. Now for the quantity of sugar from a given weight of root: 5 per cent of brown sugar is now generally obtained in the French manufactories; that is to say, 1 cwt. of sugar from 1 ton of root; and although it is not likely that a cottager, with his imperfect apparatus, should be able to obtain any thing like this amount, it must be borne in mind that even half the quantity will pay him.

"Assuming then that he must only count on this proportion, and that he grows 25 tons an acre of root, he must have about 15 rods of land in order to produce 1 cwt. of brown sugar. This, be it observed, is a low estimate, and I have reason to believe far inferior to what would be obtained by common care and a judicious application even of the general run of utensils to be found in most cottages and small farm-houses.

"*The Variety of Mangold Wurzel made use of.*—The next thing to be considered is, the variety of mangold wurzel the best adapted for making sugar. Without stopping to particularise all the different varieties, it is sufficient to state that the one known by the name Bèta álba is by many held in great esteem for this purpose, though much depends on the season. A friend of mine in France, who has given the subject much consideration, assures me that any of the common varieties will answer; and that, though usually called *beet-root*, it is not hence to be inferred that the garden beet alone is used for this purpose, but the common field mangold wurzel. The time of sowing is from the middle of April to the middle of May. Cleanliness, by repeated hoeings, is essential. This, I take for granted, every good cultivator is very well aware of. As soon as the leaves begin to turn yellow, the root may be said to have arrived at maturity; and it is time to take up the crop, and to begin the process of sugar-making; an operation which continues from October to February in the larger manufactories.

"*Process of Sugar-making.*—Take the roots up dry, and keep them dry; the smaller the heap the better, because the least fermentation will effect-

ually prevent the formation of sugar. The difference in amount and quality of sugar is always in favour of that made at the beginning of the season. The root, in keeping, undergoes a chemical change, often amounting to a total loss of its saccharine matter; although its outward appearance indicates no such change. The roots should first be washed, and then rasped, to reduce them to a state of pulp. Of course, in large manufactories, they are provided with rasping machines; and it is somewhat difficult to find a substitute on a small scale. I should imagine, though, that a stout iron plate, punched with triangular holes, the rough edges of which are left standing, somewhat after the manner of a nutmeg-grater, might answer the purpose, only that I would have it somewhat concave instead of convex. Upon the rough side of this plate I would rub the roots by hand. If there should be a cider-mill and press within a reasonable distance, it might answer to take the roots thither, slice them, and pass them through the mill. When by these or any other means they are reduced to pulp, the juice should be pressed from the pulp, which is thus done:—It is put into canvass bags, not too fine, so as to impede the running of the juice, nor yet so coarse as to let the pulp through the meshes. The bags should be so fitted as, when pressed, to occupy about an inch depth. Most manufactories use about 25 of these bags at one pressing; but this depends on the power of the press. Between every bag of pulp is laid a sort of osier hurdle, to allow the juice to strain freely from the press into the juice-cistern below. The operation of pressing should immediately follow that of rasping. This point should be particularly attended to.

"*Clearing.*—The juice being expressed from the pulp, the next process is the clearing of the juice, and here no time should be lost. This is effected by boiling; a copper boiler should be used. Get up the fire till the thermometer reaches 170° or 178°. Then add sifted lime (quick) previously mixed with water, at the rate of 5 or 6 lbs. for every 100 gallons of juice. Stir it well up, and skim the liquor. Heat it till the thermometer reaches 200°. Add sulphuric acid in small portions, diluted with six times its bulk in water, to neutralise the effect of the lime, stirring it briskly each time. The proper quantity is ascertained by carefully examining the juice every time the acid is added, with a drop of syrup of violets in a spoon, which ought to turn of a green colour. About 30 oz. of the acid to every 100 gallons of juice will be necessary. This done, the fire is quenched, and the boiler left to settle for half an hour; at the end of which time, the liquor is drawn off: by some, bullock's blood is added when the temperature of the juice reaches 190°, in proportion of 2½ pints to every 20 gallons of juice. Some, too, apply the sulphuric acid to the juice when cold, instead of hot, viz. before the boiler fire is lighted; and one recommends its being applied to the pulp before it goes into the boiler: but practice will decide all this.

"*Concentration.*—The next process is concentration of the juice, which means nothing more than evaporating from it the water therein contained. This is effected by flat pans, over a brisk fire, but not so as to burn the syrup, which is the great danger in this operation. When reduced in pan 1 from 4 to 2 in. or so in depth, it is put into a smaller pan (2), and reduced to the same depth, and afterwards into a third pan. These three removals are the work of an hour and a half. If the syrup rises, and threatens to overflow the pan, put in a small lump of butter, which will make it subside.

"*Clarification.*—This is the next operation, and may be carried on in

one of the pans used for concentration. Animal charcoal (some have even used wood charcoal) is now applied, at the rate of half a pound for every gallon of syrup, which renders it perfectly black and muddy. In this state, add blood mixed with water (stirred up well with the syrup), in the proportion of about $1\frac{1}{2}$ pt. of blood to every 20 gallons of syrup.

"Boil it a short time, after which it is filtered, and then boiled again, care being taken not to burn the pan. Great care is necessary in examining the state of the syrup from time to time. The thermometer ought to stand as high as 234°; on attaining which, the pan should be emptied: 18 gallons of syrup will be reduced, by boiling, to 11 gallons. The syrup is next cooled in a suitable vessel to 182° or 190°; and then run into moulds, but the cooling is very gradual. The pan is covered, and the heat kept in by closing the edges with flannel. The syrup is then poured into large earthen moulds, cone-shaped, and with a hole at bottom, through which the molasses drain. This hole is temporarily stopped till the mould is full. A mould contains 10 or 12 gallons, and requires a month to purge itself. As it cools it crystallises. The syrup, whilst filling, is at 67° to 77°; but, in the course of purging, it is raised to 120° and even 145°, which expedites the flow of the molasses. Our next process is *turning the moulds*, i. e. setting the cones on their bases, and taking them out of the moulds. The point of the cone is moist and syrupy: this is cut off, and boiled over again with the molasses. Thus far the process of making brown sugar: refining is a different business, and one which there is no occasion to particularise here. You will observe, that copper utensils are preferred to those of iron, the latter having a chemical effect on the sugar.

"I have thus endeavoured to present to you the principal details of the system of sugar-making adopted in France: the experience of every year adds to the general stock of knowledge thereon; and one main source of improvement consists in the application of steam to the evaporating process. However, as this would be of no use to cottagers, I have confined myself entirely to the plain common method by open fires.

"From what has been said, you will perceive that the process is neither very easy nor very simple. On the contrary, it requires great attention and accurate discrimination. Still I am of opinion that a clever intelligent cottager may succeed in making sugar for his own use, albeit not of the very first quality."*

Cider, Perry, Wines, and Spirits.—No labourer who has a clever, cleanly, industrious wife need be without these drinks, provided he has land enough to grow two or three standard apples, and as many standard pears, gooseberries, currants, elder-berries, and mountain-ash berries. South of York we should add vines, perhaps Miller's Burgundy and the common Muscadine; but, north of the Trent, we should prefer covering the walls and roof of the cottage with apple-trees or currants. In choosing the standard apples and pears for a cottager's garden, trees should be preferred which grow in narrow, conical, erect forms, in order that they may shade the crops below as little as possible, and the fruits of which are small in size, in order that they may not be easily blown down with the wind. Apples, suitable for this purpose, Mr. Ronalds of Brentford states to be, the Mank's Codlin, Red Quarrenden, Franklin's Golden Pippin, Striped Juneating, New Cluster, Golden Pippin, King of the Pippins, Little Beauty, Pomegranate Pippin, Royal Pearmain, Cockle

* Samuel Taylor, Jun., 139, Fleet-street, London, Feb. 25, 1830

Pippin, Kerry Pippin, New Lemon Pippin, and Carlisle Codlin. Pears possessing similar qualities are, the Royal Bergamot, Yellow Beurrée, Red Catherine, Hampden's Bergamot, Red Auchan, Ashton Town, Bishop's Thumb, Summer Portugal, Green Pear of Yair. The best sorts of gooseberries for the cottager are, in like manner, those which have upright shoots, and in which the bushes assume narrow conical forms; such as the Ironmonger, Warrington, and Manchester, Reds; the Bright Venus, Beaumont's Smiling Beauty, Broadman's Transparent, Cheshire Lass, Whites; Rumbullion, Golden Drop, Golden Eagle, Cayton's Venerable, Goldsmith, Yellows; and Green Donington, Warman's Ocean, Parkinson's Laurel, Perring's Evergreen, Biggs's Independent, Early Green Hairy, Greens.

Of red, white, and black currants, there scarcely can be said to be more than one sort of each. The Orleans, the Mussel, the Winesour, and the Damson are among the most useful plums for baking, and are easily preserved; and the leaves of the damson form as good an imitation of black tea as those of the common sloe. The Green Gage and Orleans are two of the best cottage table plums.

Hedges for Cottage Gardens.—In many parts of the country, all the plums, and even all the apples and pears, which a cottager could require for drink-making and cooking, might be grown in his ring-fence; by allowing the plants to attain their natural height, and by trimming the sides of the fence to the height of 7 or 8 ft., allowing the shoots above that height to spread out, either inwards only or on both sides, according to the nature of the adjoining surface. We have seen such hedges in Worcestershire and in different parts of the Netherlands and Germany, 30 ft. high, 3 ft. wide at the bottom, 2 ft. wide at the height of 8 ft., the space between forming an impenetrable fence, and 20 ft. wide immediately above. Where, from the nature of the soil or climate, neither the apple, pear, nor plum, will make hedges of this description, the sloethorn may be employed, the fruit of which may be used for all the purposes of the damson. When bruised and fermented, it makes excellent wine; or fermented with the stones broken and the kernels bruised, and then distilled, it affords a brandy much used in Hungary, and, as we can affirm from experience, of an excellent flavour. In good soil the sloe will grow 30 ft. high. The whitethorn should never be planted as a fence to the cottager's garden when the blackthorn can be got: the latter forms as good a fence, and has only one objection, an objection common to all the genus Prùnus, that of being prolific in suckers; these, of course, the cottager must take care to remove. A sloe hedge once established, on the sheltered and warmest sides of it different varieties of plums may be grafted; the more hardy kinds on the east and west aspects, and the better kinds on the south side of the northern boundary. A south wall, it is estimated, is equivalent to the removal of the trees which are trained against it 7° farther to the south; if we take the effects of the south side of a hedge as equivalent to one-third of the effects of a south wall, we shall find no situation in Britain or Ireland in which the cottager may not grow apples, pears, plums, and cherries. The principle is to form the hedge of a double row of wildings; and when it is grown five or six years, to cut down the inner row, and graft it with the cultivated varieties of the species; apples on a crab hedge, on hawthorns, or quinces; pears on wild pears, on hawthorns, mountain ash, or service; plums on sloes, and cherries on bird cherries or geans.

In this way a considerable part of the advantages of a high wall would be obtained for the cottager's garden; but, in grafting he must take care

that the scion receives the whole of the nourishment produced by the stock. For this purpose a double row of plants would form much the most suitable hedge. Where a good fence of white-thorn already exists, rather than remove it and plant another of fruit trees, it may be worth while to cut down every third or fourth plant to the ground, and graft them with pears, apples, quinces, and medlars, all of which will grow on the common thorn; the medlar more especially.

Tobacco.—Many cottagers, both male and female, smoke tobacco; and we do not see why they should not, if it affords them any enjoyment, and does not annoy others. Tobacco, in decoction, is also one of the most universal and efficacious poisons for insects; and the cottager ought to know, that with a stock of tobacco which has been fermented in the manner of hay, and with quick-lime for forming lime-water, he may destroy every insect, worm, reptile, or fish, with which he can bring one or other of these articles in contact. Lime-water, which is made by throwing a pint of quick-lime, in powder, into 40 or 50 gallons of water, stirring the mixture well, and letting it stand half an hour to become clear, will destroy earth-worms, snails, frogs, lizards, snakes, and most kinds of caterpillars before they are fully grown. It will not, however, destroy the scaly insect, woolly insect, or red spider, on trees; or the grub of the cockchafer, or the wireworm (the grub of a species of Tipula), in the soil: but for these a strong decoction of tobacco will be found effectual. Every cottager, therefore, ought to grow 30 or 40 plants of tobacco. He may sow the seed in a pot, and place it in the beginning of April in the inside of the glass window of his cowhouse, where it will get heat from the cow, and light from the open air; and he should transplant it into his richest soil in a month afterwards. When the stem begins to show flower, or has thrown out five or six leaves, he may pinch out its centre bud; this will increase the magnitude of the leaves, which may be gathered just before they begin to show symptoms of decay. The bottom leaves will be first ready, and there will be three gatherings in the season, each of which should be first slightly dried in the shade, and then put under a mat to be fermented in the manner of new hay. After having lain in this state for some weeks, it may be moistened with salt and water, rolled up into balls, and kept in a cool and rather moist place till wanted for use. In the north of Europe, where the common or round-leaved tobacco (N. rùstica) is grown by every cottager for smoking, they do not take the trouble of fermenting it, but simply dry the leaves, and keep them in bundles in a dry place, till wanted for filling their pipes.

Medicinal Plants.—Every cottager may grow two or three of these. The stalks of the medicinal rhubarb are as good for tarts as those of the species generally grown for that purpose; and the roots of every species of rhubarb partake considerably of the medicinal properties of the kitchen species. Chamomile may be grown on a seat, or on the slope of the platform on which, according to our plan, the cottage should stand. Opium is a most important medicine as a general alleviator of pain, and every cottager may produce it either from the common lettuce or the garden poppy. As a substitute for the cinchona, the A'corus Cálamus may be grown.

Chapter II.

ON COTTAGE ARCHITECTURE.

A Model Cottage for a Country Labourer.

Figs. 2 to 12 —We propose that, in all cases, cottages should stand on platforms of earth raised from 2 to 4 ft. above the natural surface; that they should contain at least a kitchen, back-kitchen, or wash-house, parlour, bedroom for the man and wife, one for girls, and one for boys. These accommodations may either be arranged on one floor, as in *fig.* 2, or on two floors, as in *fig.* 10. The offices or outdoor appendages we propose, in either case, to be a cow-house, wood-house, tool-house, pigsty, dungpit, fagot-shed, and tanks for liquid manure. The external form of the plan of the house we propose in all cases to be the square, as containing the greatest accommodation with the least quantity of walling, and as best calculated for accumulating and retaining heat. We would place this square so as that a south and north line would form its diagonal, or nearly so; by which means the four sides of the walls and roof would receive the sun's rays every day in the year. We would always, if possible, place the out-offices on the north-west side of the square, and the entrance on the south-east side; but the entrance, by means of a porch, and by placing the door of the porch on either of the sides or the front, according to circumstances, may be made from any side, so as to accord with the road or street, or other houses to which the cottage may be considered as belonging, exactly the same internal accommodations being retained; the out-offices also may be placed on any side at pleasure. The dairy should always be placed on the north-west or north-east side. The materials of the walls of this cottage we have shown in the plan as brick, and the walls themselves as built with a hollow space in the centre of each. This we propose to be done in common brickwork, by keeping the width of the wall at 11 in., working the outside fair (even); and, on the inside, keeping the headers or cross bricks 2 in. within the line of the stretching or lengthway bricks, and keeping these lengthway bricks 2 in. apart along the centre of the wall. Walls built in this way are much handsomer on the fair side, at least equally strong with solid walls, always dry, and less easily penetrated by the cold in winter or the heat in summer. The inner surface, being uneven, is peculiarly favourable for receiving and retaining the plaster. Hollow cottage walls may also be built by placing the bricks, both headers and stretchers, on edge, as practised by Mr. Silverlock of Chichester, and exemplified in several cottages built by Mr. Donald at Woking. They may be also built with bricks halved lengthways, by cutting with a wire before burning, as recommended by Mr. Dearn. (*Hints on an Improved Method of Building, &c.* London, 8vo. 1821.)

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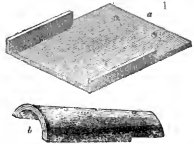


The roof may be covered with tiles, slates, thatch, &c., at pleasure; we should recommend a description of tile recently manufactured at our request by Mr. Peake of the Tunstall Potteries, Newcastle-under-Lyne. It consists of a flat tile, with the side edges turned up (*fig.* 1, *a*), and a semi-cylindrical tile for covering the edges (*b*). These tiles are much in use in Tuscany, and form a very

handsome roof, which may be tolerably flat, and yet perfectly water-tight, as in the elevation of the cottage *fig.* 12.

In countries where stone is cheaper than brick, that material may be used

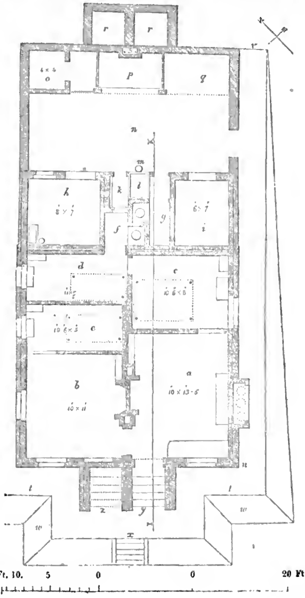


Figure 2.

C

for the walls, building them at least double the thickness, and adding that thickness to the outside, as the dimensions of the apartments are already so small as not to admit of any reduction. The walls may also be built of compressed lumps of earth, or in the *pisé* manner, or in the Cambridgeshire or West of England method of building mud walls. The latter is shortly described by Mr. Denson, in *A Peasant's Voice, &c.* p. 28.

Figs. 2 to 12. PLANS, SECTIONS, AND ELEVATIONS IN PERSPECTIVE, of a cottage with the requisite accommodations for a labourer and four children, on one floor: and for a cow, pigs, ducks, hens, pigeons, and bees, in the out-offices.

Fig. 2, *a*, *The kitchen or living-room;* the floor of tiles, or paved; in the ceiling, nearly over the hearth, a trap-door to the loft, which, in summer, may be partially opened to promote ventilation, there being a false flue in the chimney for that purpose, which will hereafter be described.

b, *A small parlour*, with a fire-place and boarded floor: as it will receive a good deal of heat from the kitchen fire, it will seldom require a fire made on purpose for it. It ought to have a small ventilator in the ceiling, near the stack of chimneys, communicating with the false or air flue, for summer use.

c, *Family bedroom;* the floor of tiles, or paved, of the same material as that of the kitchen.

d, *Bedroom for girls;* the floor boarded.

e, *Bedroom for boys;* the floor boarded. There may be a door in the partition between these small rooms, which it may be convenient in some cases to use instead of the door between the girls' bedroom and the family bedroom.

f, *Water-closet* for the mother, girls, and females, supplied by water as to be hereafter described.

The basin may be of brown earthenware or of cast-iron, so as to cost very little; the door ought to open inwards, and the small window outwards, so that every movement of the door may act as a ventilator. The basins of both closets communicate with an earthen pipe, which empties itself into the reservoir of the cesspools for liquid manure. The liquid manure thus gained will be of so much value to the garden, as alone, independently of cleanliness and decency, to justify the expense of two closets, and both of these *water*-closets.

g, *Tool-house*, and man and boys' water-closet, with an opening to the loft for ventilation: supplied with water from the same source as the other water-closet.

h, *Cowhouse*, with a post and trough for food in one corner, and a loft for hay and straw over: this loft may be got at through a trap-door, by the use of a common ladder.

i, *House for fuel lumber*, or for various other purposes, such as roots or other food for the cow and pigs. In cases where the cottager grows corn, it may be made his barn; and if it were desired to have this barn larger, it could easily be made so by projecting the whole lean-to 2 or 3 ft. farther from the main body of the house.

k, Place for *ducks or geese*, with a small poultry-stair or ladder to hen-loft over *f*, and *g*. This loft ought to be lined with straw on the top and sides, in order to keep the poultry warm in winter and cool in summer.

l, *Cistern* for receiving half of the water which falls on the roof.

Considering it to be desirable that every cottager should be perfectly independent in respect of water, and also that rain-water is the purest of all water, we propose, in every case, to collect the water which falls on his dwelling; to filter and preserve one part of it in a tank for cooking;

and to preserve the other part unfiltered, in this cistern and in a large tank below it, for the water-closets *f* and *g*, for the use of the cow and pigs, washing and cleaning, and the garden. It is calculated by Waistell that the average quantity of water which falls on a square yard of surface in Britain in a year is 126 gallons, which for this building, containing upwards of 100 square yards of roof, will give 12,600 gallons; an ample quantity for the purposes mentioned. A cottage constructed on this principle, therefore, may be set down in any situation, without reference to a natural supply of water. The cistern *l* may be of cast-iron; or of five slabs grooved into each other, and made water-tight with Roman cement; or of five plates of Welsh slate, or of 24 large flat paving tiles set in cement; or it may be made of wood, plastered inside with cement, or of bricks set in cement, and plastered within with the same material; or it may be simply an old cask. However constructed, it must have a waste-pipe, which, when the cistern is full, will flow over into the tank or well below, shown in *fig.* 5. This well or tank is to be considered as the grand reservoir of the premises; and if there should be a natural spring in it, so much the better. Should the kitchen or filtering tank fail at any time, water may be drawn from this tank, and introduced into the filtering tank.

m, *A pump*, which ought to be one of Siebe's rotary pumps, and arranged so that, in addition to the common uses of a pump, the water can at pleasure be raised from the tank below into the cistern above. Siebe's pump is particularly adapted for this purpose: it costs no more than a common pump, and is much less likely to go out of order.

n, The open yard, which should have a gentle inclination from all sides towards the dungpit (*p*).

o, *Pigsty*, with a rubbing-post in the open area or feeding-place.

Two old barrels for pigs' food will require to be placed under cover, and where they can be kept from freezing in winter, and from being extremely hot in summer. One of these ought to be filling while the other is emptying, and the contents should not be made use of before fermentation has commenced (see p. 35). The fuel-house (*i*) will be a very good situation for these tubs in summer, and a corner of the cow-house (*h*) in winter.

q, Shed for fagot-wood; *o*, *p*, and *q*, may be roofed with one lean-to or pavilion roof of uniform height and width; or, if corn is grown by the cottager, then, instead of a roof of slates, tiles, &c., a floor of joists of the width required for the roof may be substituted; and on this floor may be laid, first, a layer of fagots, and on these built the corn or hay as a stack or stacks, and thatched in the usual manner. This would save the expense of tiles or slates, and also the ground that would otherwise be requisite as a rick-stand.

r r, Two cesspools for liquid manure, i. e. for all the drainings of the open yard after they have passed through the dungpit (*p*), for the water of the two closets, and for that from the sink to be described under *fig.* 3 (*r*), including soap-suds, and all waste or foul water made on the premises.

As it is found advantageous that this liquid manure should undergo fermentation before it is used, two cesspools become necessary, and also an arrangement by which the supplies from the different sources can be turned into either cesspool at pleasure. This is to be effected by the plug-hole *s*, 3 ft. deep, the sides of which are built of brick or stone, and the bottom formed of one stone containing two holes, each 3 in. in diameter, the left-hand hole communicating with the left-hand cess-pool, and the right-hand with the other. A plug, with a handle, 4 or 5 ft. long, is to be used for

stopping the communication with the cesspool which is filled or undergoing fermentation; and as these pools are alternately filled and emptied, the plug can be removed from the one hole in the regulating well to the other. These pools are placed outside the open yard, in the supposed garden, for the greater convenience of emptying them.

The platform on which the house stands, or appears to stand, and which will be better understood by referring to *figs.* 8 and 12, is level on the entrance front (*t t*), and on the other fronts or sides it forms inclined planes, for the sake of easy ascent and descent to the out-offices or to the garden: the inclined plane commences at *u* and ends at *v*.

The platform is 5 ft. broad, and includes a border of 1 ft. for wall-trees and flowers next the house, and a margin of 1 ft., which should be of turf on the outer edge, leaving a walk between of 3 ft., which ought to be gravelled. The exterior sides of the platform (*w*) may have different degrees of slope, according to the nature of the soil and the culture or application of the platform. For a loamy soil, where the platform is to be covered with turf, with a furze or a box hedge about 2 ft. high along its upper angle, the slope may be 45°; where a loamy soil is to be cultivated as a flower-border, the slope may be from 30° to 35°; a sandy soil should have a still greater slope. Where stones are abundant, the slope may be formed into rockwork, with a small edge at top, or a dwarf wall, or a row of rough stones. Along the upper edge of the slope, in the line of the small edge, we should recommend, in almost every case, some standard fruit trees to be planted, in order that their roots might bring into use the soil accumulated in the platform, and their tops the vacant space, speaking with reference to vegetation, over the roof of the house. In some situations, it might be worth while to form a rough trellis over the roof, and at about a foot above the roof, and on this trellis to train either apples, pears, plums, or vines: in severe climates, ivy, for the sake of retaining heat in winter. On the side walls of the cottage we would have fruit trees or vines, together with ever-flowering roses, honeysuckles, clematis, white and yellow (J. frùticans) jessamine, Chimonánthus fràgrans, and Wistària Consequàna.

The platform may be ascended from the garden, either by the inclined plane (*u v*) leading to the out-offices; by a similar inclined plane directly in front; or by steps (*y*). The descent to the cellar is by 6 or 7 steps (*z*).

Fig. 3. PLAN OF THE CELLAR-FLOOR, HEATING-FLUE, AND FOUNDATIONS.

a, *Steps of descent.* If the front of such a porch were to any other quarter than the south-east, the porch should be larger with an exterior door; if it fronted the south-west, the entrance to the porch ought to be on its south side, for the sake of protection from the weather.

b, Apartment serving as a *back-kitchen*, wash-house, brew-house, bake-house, &c., as well as for boiling or scalding food for the cow, pigs, and poultry.

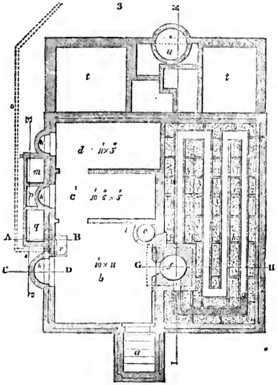
c, *Store-cellar* for potatoes, beer, home-made wines, salt meat, and similar articles of permanent provision.

d, *Milk-house and pantry:* in the farther corner in the ceiling ought to be a small grated opening, communicating with the empty space in the wall, to promote ventilation; the exterior window ought to be of wire or hair-cloth, which both excludes air and heat or cold.

e, *Copper* for brewing, washing, &c., unless a copper pot or iron box is fixed over the oven, when a separate copper becomes unnecessary.

f, *Oven* for baking, and also for heating the floor of the living-room and family bed-room.

The courses of this flue are so contrived that the covers, supposing them to be one-foot tiles, will form the floor of the two rooms which it heats.



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The flues may be of any convenient depth exceeding 18 in., their sides built of brick on edge, not plastered, and the intervals between the flues filled up with loose stones or rough gravel. If the flues are made deep, which in some cases may be found cheaper than preparing a raised solid basis on which to build shallow flues, then the side walls may be tied together by brick-on-edge work (*h*), and the foundation of the partition wall, which separates the family bed-room from the kitchen will contribute to the same end. To equalise the heat given out by the flue, and to prevent the kitchen floor from being too hot, where the flue proceeds from the oven, a double covering is there shown, with a vacuity of 6 in. between the under cover and the floor, from the oven *f* to *g*; a section of which may be seen in *fig.* 4. at *g*.

As fagots are intended to be burnt in the oven, the soot produced will be very trifling; but the flues may be cleaned once a year by taking up a tile at each end of the different courses of the flue. A little reflection

will convince any one of the immense superiority of this mode of heating the air of a room over any other whatever. By open fire-places, by stoves, steam-pipes, or water-pipes, unless indeed these are in the floor, and by heated air, the coldest stratum of air is always found immediately on the floor, where for the sake of the feet and legs, the air ought to be hottest; by the method of under-ground flues the lowest stratum is necessarily the hottest, which must be preferable for the feet and legs of grown persons, and for the whole bodies of little children. The heat being diffused over the whole surface of the floor, must contribute greatly to the equality of the temperature throughout the apartment, and the mass of loose stones will continue to give out heat for a day or two, according to the season of the year, after every time that the oven is heated. The heat from the floor, in its ascent to the roof, will warm whatever it meets with; but this is not the case with either raised stoves or open fires. In heating by open fires or common stoves, the heat ascends directly to the ceiling, and is there in a great measure wasted as far as it respects the bodies of the persons in the apartment; but by this mode the ceiling will not in general be hotter than the floor. Except when there is a fire in the oven, its door must be kept perfectly close, and the damper in the upright flue, to be afterwards mentioned, nearly closed.

Over the oven, and as a cover to it, instead of brickwork, might be placed, or built in, a cast-iron box or iron pot for heating water, as shown by the dotted lines in the plan *fig.* 3, and by *k* in *fig.* 4. The upper surface of this box or pot might form a part of the kitchen floor, as in *fig.* 11; and might have a properly secured flat lid on that side, to admit of putting in and taking out water: or the box might be entirely buried in masonry, as in *fig.* 4, and in that case a part of it should project from the wall into the back kitchen, and should have a lid to open, for the purpose of filling and cleaning out, and a cock (*l*) for the purpose of drawing off the water. If this box were 2 ft. or 2½ ft. square, and 9 in. or 10 in. deep, it would supersede the necessity of the copper (*fig.* 3 *c*), and in summer, when the heat of the flue was not wanted, a damper withdrawn would admit the smoke to ascend directly to the chimney top.

A family with a pot or box of this kind over their oven, the box or pot either opening only from the kitchen above, or both from above and from the back kitchen, would, throughout the year, scarcely require any other fire than what was made in the oven; all their roasting and baking would be done in the oven, and all their boiling in the pot or box over it. As it might not be always convenient or desirable to boil the large box or pot full of water, there might be a well of 6 inches diameter and 9 inches deep cast in its bottom, and the small quantity of water which this well would contain would be boiled with very little fuel: for tea, or any similar purpose, a tin jug of water might be set in among the water in the well, which would keep the former perfectly pure. A very small quantity of fuel consumed in such an oven will have a powerful effect in heating the water above it, from the difficulty of the heat escaping by the sides. Water might easily be drawn out of this well, or out of the box or pot when in common use, from the upper kitchen, without stooping, by a ladle with a long handle. One half of the water which falls on the roof of the building, we have before stated, is proposed to be conducted into the cistern (*l*), for general purposes; the remaining half we propose to conduct into a tank, thence to pass through a filtering stratum into a reservoir, for the kitchen.

m, *The receiving tank*, which, in addition to the pipe from the roof, has another pipe from the inside with a funnel, into which to pour a supply for

filtration from the pump (*fig.* 2, *m*), in times of great drought, or at any time when the kitchen reservoir was exhausted.

n *Waste-pipe* from this tank, communicating with the drain-pipe.

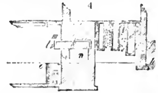
o, *Drain-pipe*, communicating with the well of the cesspools (*s* in *fig.* 2).

p, *Filtering-tank*, consisting of sand and charcoal, placed on a bottom raised 4 in. from the bottom of the receiving-tank.

The filter, including the false bottom of slate pierced with holes, and the top, a thin plate of filtering stone, is 1 ft. in thickness; the water ascends through it, and then runs off into the reservoir tank, so that the operation of filtering cannot go on unless there is a depth of at least 1 ft. 6 in. of water in the receiving-tank. There is a large cock or hole, stopped with a plug, near the bottom of the receiving-tank, by opening which, when the reserve tank is full, the filtered water will rush backwards through the filter, and thus free it from impurities. There are several advantages attending this arrangement, which we shall not stop at present to point out.

q, *Receiving-tank*, for the filtered water, communicating by a cock with the sink *r*, and the sink having a stink-trap (of which there is a cheap and excellent sort in earthenware, by Peake of Tunstall,) connected with a waste-pipe *s*, which joins the drain-pipe *o*.

Foundations of the outbuildings, shown in *fig.* 2 by *f g h i k l* and *m*.



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u, *Tank*, or well of water for general purposes, and for supplying the filtering tank in times of extraordinary drought.

Fig. 4, *section on the lines* O H *in Fig.* 3, to show the depth of the flues; the double cover and vacuity between the covers at *g*; the cast-iron box of hot water, *k*; the cock for emptying it, *l*; the small lid for filling it, *m*; the oven, *n*; the copper, *o*; the natural surface of the ground, *p*; and the surface of the platform, *q*.

Fig. 5. *Section on the line* I K *of Fig.* 2.

a, Natural surface of the ground.

b, Surface of the platform.

c, Level of the foundations of the cellar.

d, Foundations of the other walls.

e, Foundation of the oven.

f, Foundation of the partition wall between the living-room and family bed-room.

g, Well or tank.

h, Siebe's pump, with an ascending pipe into the general cistern.

i, Cistern for the water-closets.

k, Place for ducks or geese beneath.

l, Hen-house, with tool-house and man's water-closet under.

m, Family bed-room.

n, Loft, with ventilator, or trap-door, from the kitchen, and opening, near the false or ventilating flue.

o, Kitchen.

p, Porch.

q, Cover to the false or air-flue, which is only kept open during summer to prevent excessive heat at that season: it is simply a tile supported by an iron stalk, in order to exclude rain, instead of being entirely removed.

r, Oven.

s, Water-box over.
t, Commencement of flue from oven.
u, Continuation of flue.
v, Cornice to chimney-top, made large so that swallows may build their nests there; these birds being of great importance as destroyers of winged insects, on which they live entirely.

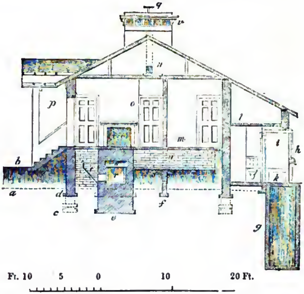
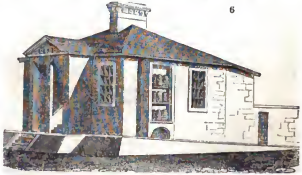


Fig. 6. Perspective elevation, in which is shown the ascent to the platform, the steps of the porch, the inclined plane; the bee-house as a



substitute for a false window, a place for a dog under it, the pigeonry over the porch, and the door to the yard behind.

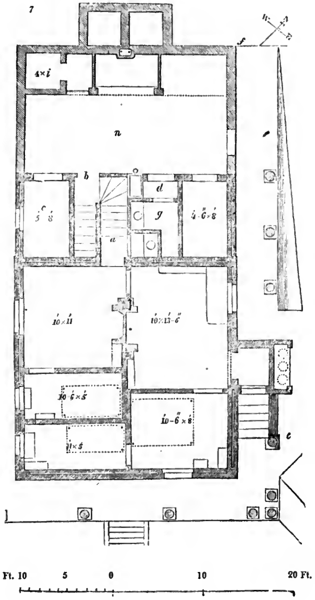

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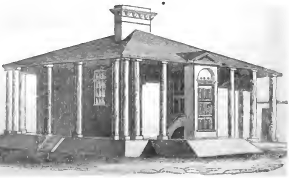
Fig. 7. Plan of a Cottage with the same accommodations as the foregoing, but differently arranged, and with a veranda. The difference in the aspect of this cottage will be ascertained by observing the compass; the north and south line being in the direction of from left to right, whereas in plan *fig.* 2 it is from right to left. The entrance, therefore, is placed against the north-east front, in order that, by placing the door on one side of the porch, it may open to the south-east. An interior arrangement is shown, which we consider preferable to that of *fig.* 2, because the communication with the cellar, by means of the stair (*a*) in the lean-to, and the direct entrance to the yard (*b*), is more convenient. The size of the cow-house (*c*), though somewat diminished, is still large enough for a small cow; the space (*d*) for ducks or geese, and for a ladder to the hen-house, is not quite so convenient as in the other plan; but on the whole, notwithstanding these drawbacks, we consider this plan as better arranged than the preceding one.

The platform (*a*) on the outside is level as far as the steps to the porch (*e*), and thence it forms a slope to the natural surface.

f, The veranda, which is supported by trunks of larch or spruce fir-trees, with the bark on, will add much to the comfort and economical uses of this residence. It will serve every year for drying kidneybeans, and other beans and peas in the straw; for hanging up Indian corn or tobacco, or any sorts of garden seeds or garden herbs which the cottager may wish to dry. In wet seasons he may dry the whole of his wheat, barley, oats, or even hay there; the family washing may be suspended on lines, and dried there in all weathers; various sorts of work may be performed with comfort, and children may be sent out to play during rain or snow.

Fig. 8. *The perspective elevation* shows the bee-house, with pigeon-house over, and a place for a dog or for rabbits, entering from beneath the steps to the porch.

8



Figs. 9 to 12. *A design for a Cottage, with the same general accommodations as figs.* 2 and 7; but without a cellar floor, and with the addition of a bedroom-floor.

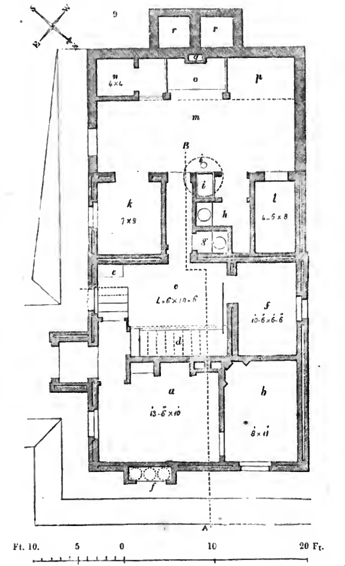
Fig. 9. *Ground plan.*

a, Kitchen.

b, Parlour.

c, Back kitchen, the descent to which is by five steps.

d, Stair to bed-rooms, under which are the oven and boiler, the former



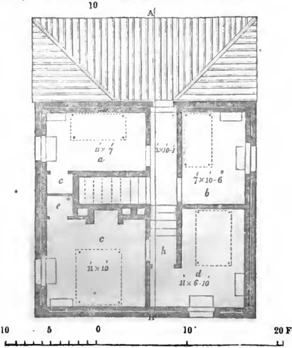
with its flue under the kitchen and parlour floors, which are both paved with tiles or stone.

e, Sink, supplied as in *figs.* 2 and 6, from a filtering-tank.

f, Dairy and pantry.
g, Women's water-closet.
h, Tool-house and men's water-closet.
i, Cistern for water-closets, with tank or well under, and place for ducks and geese, and ladder to poultry-house at one side.
k, Cow-house.
l, Wood, or other fuel.
m, Open yard.
n, Pigsty.
o, Dung-pit.
p, Fagot-shed.
q, Well, or regulating plug.
r r, Cesspools.

The platform is the same as in the other plans, the slope beginning at *c*, and continuing to the extremity of the outbuildings.

Fig. 10 *shows the bed-room floor*, in which the bed-rooms *a* and *b*, over the back kitchen and dairy, are on a lower level than the bed-rooms *c* and *d*, over the kitchen and parlour. The positions of the different beds, chests of drawers, and dressing-tables, in the different rooms, are indicated, and the vacuity in the exterior wall is shown as in the ground plan.



e, Two closets.

This design is more particularly calculated for low, moist, shady, or confined situations, where it might not be considered advisable to sleep on the

ground-floor: it is of course somewhat more expensive in execution than either of the two preceding plans, and not quite so well adapted as them for walls built in the *pisé* manner.

Fig. 11. *Section on the lines* A B *in figs.* 9, 10, showing the level of the open yard, *a*; passage from the back kitchen, *b*; sunk area under the stair to give head-room for attending the oven, *c*; oven, *d*; water-box over it on a level with the kitchen-floor, *e*; flues for heating the kitchen, *f*; platform, *g*; natural surface, *h*; lower bed-room, *i*; larger loft over, *k*; closet, *l*; situation of openings to the false flue for ventilation, *m n*; cornice for swallows, *o o*.

11

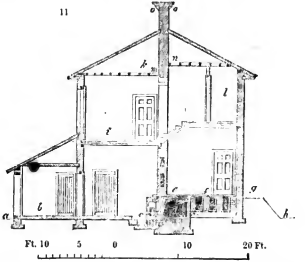
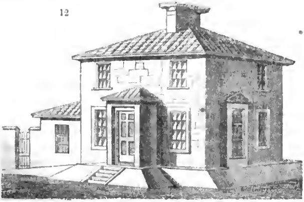


Fig. 12. *Perspective elevation of figs.* 9 to 11, in which are seen the bee-house with pigeon-place over, and, on the left, the window to the cow-house and the door to the yard.

12



No estimate is given of the expense of erecting these cottages, because that will vary exceedingly in different parts of the country. For 20 miles round London, the design *figs.* 2 to 6 would cost, according to the estimate of an eminent builder, upwards of 300*l.*; *figs.* 7 and 8, upwards of 350*l.*; *figs.* 9 to 12, upwards of 400*l.* In Sussex these designs might be erected for less than half the above sums. A proprietor, with the materials on his own estate, whatever might be the part of the country in which that estate was situated, might erect the two first designs at little more than 100*l.*, and the third at less than 150*l.* Provided an industrious labourer could get a lease for a long period of years, or in perpetuity, at a moderate rent, he might erect an excellent cottage, with all the above accommodations, by co-operation or exchange, on one or other of the following plans:—

1. By contracting to exchange a part of the labour of his hours of recreation with the tradesmen requisite to assist him with labour. By entering into a similar contract with those proprietors or dealers, or with the parish to which he belongs, for timber and other materials, to be placed against a certain portion of his hours of labour; all the walls being formed of earth in the *pisé* manner, or otherwise, by himself and another labourer, and by degrees, even if the time occupied should be two years.

2. Six persons, viz. a bricklayer or mason, a carpenter, a plasterer, and a slater or thatcher, and two labourers, might join together and construct such a cottage at their leisure hours: they might then either let it for rent, or sell it and divide the profits: or they may build six houses, and each occupy one; priority of occupation being determined by lot.

The great secrets, by which a labourer can obtain a cottage of this sort, are co-operation, and exchanging labour for labour, and labour also for materials. It is true this is rather a retrograde step in the progress of civilization; but we apprehend it to be the most suitable one to the present circumstances of the labouring classes in Britain. The great difficulty will be in getting land sufficiently cheap, and on a long lease. It seems to us that the annual rent for land, let in perpetuity to be built on, should be less, rather than more, than the common rent of such land when used for ordinary purposes in its neighbourhood; because rent, where there is the security of a house for its being regularly paid, must eventually be a more certain annuity than the rent depending on the success of crops.

Perhaps it may be asked why such plans as might be built anywhere for 50*l.* or 60*l.* have not been given: our answer is, that for such cottages no plans are wanted; they may be seen everywhere. In England they can be built by any carpenter, with the assistance of a labourer: in Scotland what is called a "decent cottage" consists of two apartments, a *butt* and a *ben*, with earthen floors, and without ceilings; in Ireland a hole is dug in a dry bank on the side of a hill, and a roof of *rungs* and turves put over it. We have no wish to increase the number of such wretched habitations: we think labourers, as a part of the human family, deserve something better, and we wish to raise their taste. There is abundance of land, of materials, and of labour, in Great Britain, for transforming every two-roomed hut into such cottages as we have described; and that these means should be neglected must be attributed to ignorance, to poverty, and to the neglect of taste, of comfort, and often even of decency which these induce. All useful knowledge, and all useful food, lodging, and clothing, are surely destined to be common to all men.

Chapter III.

COTTAGE ECONOMY.

No young man, about to enter the married state, can be totally indifferent to the consequences likely to arise from a change of such magnitude. He must naturally expect a young family; and for this young family it is his imperative duty to make a provision. He must expect, likewise, that, year after year, the wants of this family will be increasing, and, consequently, demanding greater and greater sacrifices, with increasing exertions, on his part; and that these sacrifices and exertions will be required of him, not merely for a short season, but for almost an unlimited, or, at least, an indefinite period. These weighty considerations, one would reasonably suppose, would induce any man of ordinary prudence to examine into his "ways and means;" and if his little stock of money is low, as is too frequently the case, let him immediately begin to hoard, week after week, with unremitting care, *every sixpence;* for, after all his care, he will still find great difficulty in answering the demands made upon his pocket by such an eventful change. He must provide a cottage, and furnish it; he must have a garden to produce vegetables for himself and family, with nearly as many more as will keep a pig. With these to make a beginning (and they ought to be considered indispensable), a poor man may, by great industry and good management (to teach him the latter is the object of these remarks), contrive to rear a family of three or four children, and live with his wife in comparative comfort and respectability. While on the other hand, when a man is so unfortunate as to be drawn into a hasty and improvident marriage, his friends are probably displeased, and unwilling, or what is more likely, unable to assist him. Thus he is compelled, being pennyless, to take up his abode with his wife's relations, who are as poor as himself (save a little old furniture, of which he has the use); and here he thoughtlessly spends, year after year, his scanty earnings, without attempting to purchase the few little necessaries to furnish a cottage for himself, merely because he is not in the immediate want of them, until his increasing family absorbs the whole of his receipts. His wife's relations quarrel with him, or can no longer shelter him; and the same individual who would, in all probability, in more favourable circumstances, have become a useful member of society, becomes reckless and dependent, and prone to look upon all above him as his enemies and oppressors. Much of this evil might be kept aloof, if the labourer would take care not to enter upon a married life until he had secured to himself a decently-furnished cottage and garden.

With a cottage of at least two rooms; with a dairy, pantry, and a coal or wood-house; and a garden of not less than 20 rods of ground adjoining; and, with a clean industrious helpmate in his wife, a labouring man is a person of some consequence. He fills a station which, though humble, is yet important; because, from the moral or immoral conduct of him, and the class to which he belongs, much good or evil will ensue to society. His actions will not only have a baneful or beneficial influence on his own immediate offspring ("as is the father so is the son"), but, through them, on society at large. If distress and difficulties are allowed to accumulate around him, it is to be feared that he will soon cease to respect himself. Profligacy and dissipation ensue: his home becomes wretched; and, with a wretched home, a man has little motive to be

industrious, save merely to obtain the means of existence. Without a character, he has no motive to be honest but the fear of the law. On the other hand, a poor man's self-respect, his desire to improve his condition, to provide for and rear his family in a decent and creditable manner, all proceed, next to religious motives, mainly from the fact that he has a comfortable home—a home which he loves.

Let us, then, suppose a new-married couple in possession of a decently-furnished cottage: the first resolution they will, or ought, to come to, will be to save a little out of their earnings; and, for that purpose, they will consider how they can get rid of the baker, butcher, and grocer.

Making Bread and Brewing Beer.—A sack of flour, a flitch of bacon, and a barrel of beer, are as agreeable articles, in the shape of household stuff, as any poor man can wish to contemplate. With regard to the first, let a sack of wheat be purchased at the market, or at the market-price from the farmer. After grinding it at the nearest mill, let only the very coarse bran be taken out of the flour; and this flour, when made into bread, will be fine enough for any healthy person, and be more nutricious than the compound of flour, potatoes, and alum, which otherwise he will have to purchase of the baker: and, as to the making up, every woman ought to be able to make bread; indeed, the process is so simple, and generally known, that it would be useless to state the particulars, unless it be to observe, that, after the *dough* has been well kneaded, and *risen* with the yeast, in afterwards making it up into loaves or cakes, the less it is worked with the hands the better, as, if kneaded much, the bread will always be heavy. Another advantage attends the cottager who purchases his own wheat. There is the bran, every now and then, for the hog-tubs; and, as for yeast, he will see how to obtain a regular supply throughout the year, and some to sell besides, with very little trouble or expense, when we speak of brewing.

No man can be said to be very poor who has got a good flitch of bacon or two hung up in his house: it is a great promoter of happiness, and makes a man independent of the butcher; he can at any time have a good supper or dinner, without sending his wife, or running himself, to the market or butcher's shop, to get a bit of meat at an extravagant price, more than a quarter of which will be wasted in dressing. How this bacon may be procured we will afterwards show.

In brewing, as in baking, the wife must likewise be the operator, for one is as easy to do as the other: indeed, it is as easy to brew as to make tea, at which most women are dexterous enough; nor does it require any very large vessels for either brewing or preserving beer. A pot or boiler that will hold four gallons, with a small square washing-tub, and a bucket or two; and, if a small cask cannot be got, two or three large jars, to preserve the beer in, are all that need be required in the shape of utensils.

With a peck of malt and two ounces of hops a cottager's wife may go to work. First, let her put the peck of malt into a tub (a washing-tub will do), with a small hole bored in the side level with the bottom, and covered inside with a few small birch-twigs and a piece of coarse canvas, while the outside is stopped with a wooden peg; then let her boil rather more than three gallons of water, and as soon as it boils let her take it off, and leave it to stand until she can see her face in it. She must then pour the hot water upon the malt, stir it well for a few minutes to mix it, cover it over with a sack or cloth, and set it by the fireside, to keep it warm, for three hours; after which let her pull out the peg, and drain the whole into a

bucket. Immediately after let her put in the peg, and pour in upon the wet grains as much water as before, quite as hot, or a little hotter than the first; then cover it over, and set it by the fire, as before, for two hours. This finishes the mashing. The moment the boiler is emptied the second time, put into it the first quantity run out; boil it a quarter of an hour; add the two ounces of hops, and continue the boiling half an hour longer. Then strain the contents through a fine sieve (to keep back the hops), into as shallow vessels as can be procured, to cool the wort as quickly as possible. Boil the second run half an hour with the same hops as before, and cool the wort in the same manner. Mix them, and there will be above five gallons, which, when mixed in the washing-tub with a small tea-cupful of yeast, will ferment for two or three days. It should, during this time, be frequently skimmed; for this is *yeast* as well as the sediment. When this fermentation ceases the beer may be put into jars, where it will probably ferment, but slightly, for two or three days longer, after which it is fit for drinking. A good cask would, of course, be better than jars; and the beer also would be better, perhaps, if brewed in larger quantities: but good beer may be brewed easily and well with common domestic utensils, and without at all injuring them; for, surely, a washing-tub is not a straw worse for having a hole bored into it;—a small cork will effectually repair that in half a minute.

This, then, is the beverage which might, with great advantage, supplant the more costly and less nourishing beverage of tea. Beer is always ready; it is wholesome, it is hearty, and it is cheap; it does not require the ceremony of boiling the tea-kettle, nor the parading of teacups and saucers; it does not require sugar and milk to make it palatable; it does not weaken the nerves, but, while it exhilarates, it nourishes and strengthens. Look, too, at the comparative cost of tea and beer for one week. We may estimate the weekly consumption of tea at 3 ounces, costing 5*d*. an ounce, equal to 1*s*. 3*d*.; 1 lb. of sugar, at 8*d*.; milk, 7*d*.; amounting to 2*s*. 6*d*., without reckoning anything for butter, fuel, or for breakage; while, on the other hand, a peck of malt and 2 ounces of hops cannot amount to more than 2*s*. This malt and hops will produce upwards of 5 gallons of good beer, affording three pints a day for a fortnight: and this, too, without any extra expense; for nothing can be fairly charged against the beer for fuel, &c., for the grains and yeast cover all expenses; the yeast will keep, and will always be ready for baking.

Whilst we warmly approve of every cottager brewing his own ale or beer, and would wish him to brew it good, and drink it twice every day, we would not deprive his wife of a cup of tea, at all events, once a day, and twice if she chooses it, unless she prefers coffee in the morning. We object to diminish the articles which constitute the necessaries of life for the labouring classes, by which we mean all those who have no other capital than their hands or their heads; because the value of labour will always be estimated by what constitutes the necessaries of life for the labourer; although no doubt it is always regulated, to a certain extent, by the supply of labourers. A mud cabin, a bundle of straw, and potatoes, are the raw materials out of which is formed a country labourer in Ireland, and he is paid with 5*d*. a day; but, as we have lately seen, he will work for 3*d*., or even 1½*d*. In Scotland the huts for labourers are of stone, often colder than those in Ireland, and, as a shelter from the weather, nearly as wretched; but the inhabitant is a little more particular respecting his bedding and body-clothing, and to potatoes

he adds oatmeal. The cost of production being thus greater, the wages vary from 1s. to 3s. a day. Before a Scotch labourer will work for 1s. a day he will emigrate; because he cannot live upon that sum, and has not such a ready claim on his parish as the English labourer. If English labourers could be made to live upon potatoes, and lodge in mud cottages which they could erect themselves, the number of labourers would soon be as great, and the price of labour as low, as in Ireland, bating the difference of the cost of raising potatoes in the two countries. If, on the other hand, the labourers of Ireland could be refined to such a degree as not to be able to exist without good bread, butcher's meat, beer, and tea and sugar, the wages of labour, even where there was a glut of labourers, would rise accordingly. Let us strive to add to the innocent enjoyments of all classes, especially of the poorest, who are necessarily debarred from so many gratifications. Let every labourer, therefore, have good ale, at all events, and try hard for tea, coffee, and sugar for his wife, and milk for his children: what is powerfully desired will be found, and what is found essential will be retained.

At the same time it must not be forgotten, that the only way in which a labourer, or any one else, can acquire capital is by saving it out of his income; and, therefore, having once procured such wages as will enable him to enjoy tea, coffee, and other things, the secret of his making a little money is to deny himself such a part of those things as he can do without, and yet not lessen his strength, or injure his health; but we would no more banish tea and sugar from the cottager's table than we would flowers and fruits from his garden.

Nor do we object to tea because it often occasions gossiping among the cottager's wives. Why should not the cottager's wife have her gossip as well as the wife of the landlord? Some relaxation is necessary to every human being: let the wife, therefore, enjoy herself in the evening over a cup of tea, and it will be something for her to look forward to during the labours of the morning. Neither man nor woman can go on for any length of time without relaxation and amusement. An immoderate use of tea is no doubt injurious to the nerves, and ultimately to the general health; so is ale, if taken to excess. We have no fear of the labourer's injuring himself with tea, or even spirits; all that we are anxious for is, that he should have plenty of both. If a man chooses to kill himself with spirits, ale, or tea, he is to be pitied and avoided. But the cares of life must be forgotten at intervals; and the greater those cares are, the greater is the necessity for amusement. Few men in comfortable circumstances kill themselves by drinking; and in the wine and brandy countries of France, where those liquors are within the reach of the poorest classes, intoxication is a most rare vice. Make labourers comfortable, therefore, and you may safely leave spirits as low in price as they can be sold; any evil result will soon cure itself.

Pigs.—In addition to all the benefits attending baking and brewing at home, there is this important advantage, in having a quantity of bran and grains occasionally to add to the daily accumulating mixture of cabbages, greens, carrots, turnips, greasy wash, beech mast, acorns, &c. &c., in the hog-tubs, to make a provision for a pig. It should be remembered that one tub is not enough even for one pig; and, however contrary it may be to general opinion or common practice, it will be found (and it is a thing worth knowing) that a pig will fatten sooner on stale food than on fresh, perhaps owing to the more uniform quality of the food; for although a

pig is a gross, and certainly un accommodating, feeder; nevertheless, he prefers a regular or a gradually improving diet to one of a varying nature; and great inequality must inevitably attend the daily mixture of fresh food. For this reason, two tubs should be placed, side by side, one always being filled while the other is emptying; and a portion of this stale wash, daily mixed with a few potatoes that have been boiled, bruised, and put away dry in a box or basket, will make good food for a growing pig during the summer season; though, of course, more substantial food will be required before the animal can be properly fattened.

Sty.—If a sty has not already been erected near his cottage, no industrious man will rest an hour until he has constructed one; which may easily be done, when no better materials can be got, with a few posts, well wattled and thatched with heath or furze. For paving a sty, large flat stones are better than bricks; and, where the pig has to lie, the ground should be kept high and dry. A channel on the lower side should likewise be made, to take the washings of the pig and rain into two cisterns or cesspools, which should be sunk, side by side, close to the sty, so as to catch every particle of manure, liquid as well as otherwise; and, though this simple provision may at first appear trifling, it will soon be found of great importance to the garden; for it is greatly on his pig that he must depend for a supply of manure, without which his garden will soon become unproductive. The sty ought to be constructed with a shed-roof, and should be about 6 or 7 ft. wide, with height in proportion. In order to keep the pigs dry, a sufficient slope must be given, not only to the floor of the inside, or sleeping-place, but to the outside, or eating and exercising area; and, according to Marshal, every pig should have a rubbing-post.

The pig is an animal by no means nice in its food, as he will graze, eat cabbage-leaves, common turnips, Swedish turnips, turnip-tops, potatoes, &c. &c.; but the potato is the most nutritious article generally produced from the garden. Potatoes ought never to be given in a raw state; for it is an established fact that, when so given, they will scarcely keep swine alive; but, when boiled (and the water in which they are boiled should be invariably thrown to the dungheap or cesspool), potatoes will contribute not only to the growth but to the fattening of pigs. Such food, given in abundance, will make a pig grow freely, and keep him in tolerable condition; but, for properly fattening him, food of a more nourishing quality must be given. Barley-meal, buck-wheat, or barley-meal and pea-meal, given when they are slightly sour and fermenting, are considered very excellent for fattening hogs. The animal ought to be inured to this food by degrees, in order to prevent a surfeit.

Having now got his sty in order, let him look round among the neighbouring farmers, and try if he can purchase a young spayed sow, that has had but a litter or two of pigs.* Such an animal will grow faster, and fatten quicker, than a younger pig, however good the breed. At last, having got such an animal fairly lodged under the roof of his sty, it will daily become of more importance in his eyes; it is his live-stock; is constantly increasing in size and value; and, in fact, should occupy a great deal of the labourer's spare time. If he observes but a few dry leaves blown into a ditch, he brings them home for bedding; or he

* He should only keep one pig at a time, when he has no cow; but when he has a cow, he can keep two. In either case, he can kill one for pork; say on the 1st of August; one for bacon, about November; and the other at Christmas or Candlemas. One of these he can sell, to help to pay the expenses of purchasing.

picks up a bundle of fern by the road-side; in short, anything which he can honestly lay his hands on will always be brought home, and he will never grudge any trouble of this kind. Besides, all this helps to make manure; and no manure is so rich as that which is taken from the pigsty. This animal is now, however, to be well supplied with food, and fattened against Christmas. The hog-tubs will now be had in requisition; and their great value will be properly appreciated, for there will be no necessity for *messing* every time the pig wants a meal: with a portion of stale wash, and a few mashed potatoes, the pig will grow and do well till the end of September or beginning of October (potato-digging time).

The quantity of potatoes requisite to feed a bacon pig of 20 stone, or 320 lbs. weight, allowing 1 peck per day, from the 1st of August to the 31st of December, is 38 bushels; and a load of oatmeal, of 16 stones' weight, will be required to finish fatting.

The quantity of potatoes required to feed a pork pig of 8 stone, or 128 lbs. weight, from the 15th of July to the 14th of September, allowing 1 peck per day (pork will be quite fat enough without oatmeal), is 15½ bushels.

The quantity of potatoes required to feed a pork pig of 6 stone, or 96 lbs., 1 peck per day, from the 31st of December to the 12th of February, is 11½ bushels.

At this season a sack of barley-meal should be purchased; and about 3 or 4 lbs. of this meal, with 13 lbs. of mashed potatoes, which we shall show may be set apart for that purpose, when we speak of the produce of the garden, being daily added to thicken the stale wash, will make excellent food; and, if the pig has been well attended to during the summer, it should not fall short of weighing fifteen score pounds by Christmas, to which time the food is calculated to last.

There will, of course, be no want of good meat when the pig is killed; and the cottager may perhaps dispose of a few joints, such as the spare-ribs or loins, which his richer neighbours will always be ready to purchase. This trifle may assist him to buy another pig, for he should never be long without one. It is almost unnecessary to observe that a hog in fattening should always be kept clean, warm, and dry; never have more food given at one time than he will consume; should be fed four times a day; and not killed till he is almost too lazy to come to his trough. A few peas are at all times desirable; and it is a good plan to have a dry corner boxed off for holding a few. After eating a few peas, a pig always wants to drink, and the stale wash will be ready for his use.

Bacon fatted in this manner will certainly not be equal to that fatted on barley-meal and skimmed milk. But this mode produces the best quality and greatest quantity of bacon, from the particular quantity and quality of food, which can alone be procured by the labouring man.

Rather less than a quarter of an acre will produce an abundant supply of kitchen vegetables, bacon, or pork, for a labourer, his wife, and four children, for a year, allowing upwards of 10 lbs. avoirdupois of bacon, ham, or pork, a week: as, however, hams are not the most economical food; these may be sold, and, with the produce, a pig may be purchased to make pork of.

A couple of Leicester ewes will prove much more profitable than a goat; they will bring at least two good lambs in the spring, that will sell well; and, should they be milked after the lamb is weaned, they will produce about one quart per day each, for three months. Their fleeces will help to clothe the family, either manufactured, or in waddings for bed and body-clothes.

Should the Peruk sheep of Ladusk be introduced, and be found to succeed as well as Mr. Moorecroft expects (*Trans. R. Asiatic Soc.*, vol. i.), they will be found invaluable for the cottager. They are said to be as easily kept as pigs, to give two lambs in twelve months, and to admit of being twice shorn within that time.

Rabbits never thrive well unless they are kept dry, and have plenty of food, such as clover, ribgrass, lettuces, dandelions,* sowthistle, &c. &c.; indeed, almost anything; but a few oats should be frequently given them in a little dry trough. These little creatures devour a prodigious quantity of food, considering their size, and certainly would never pay for keeping; but, in a family, nothing can be better amusement for a parcel of boys than to cater for their rabbits. They are excellent food, aad very prolific, if well atteaded to; but everything depends on that.

Fowls and Ducks.—Every man who keeps a pig should keep fowls. Three or four hens and a coek will prove no small addition to a poor man's stock; and a few potatoes and peelings, with the *run* of the pig's trough, which they will always keep clean, will be all they require in the summer; but to make them lay eggs, when eggs are valuable, they must be well fed with oats, barley-meal, or Indian corn; have a dry place to roost in, to shelter them from the wet weather, and be kept quite clean. In the depth of winter, geese and other poultry must be fed, as they cannot obtain much out of doors; and, if suffered to get lean at this time, they will not lay well or early in spring. Young pullets, 9 or 10 months old, are the best for laying in winter. Ducks are both useful and profitable: they clear away much unsightly offal, will travel a great distance from home in search of food, require but little at home, and lay a great number of eggs; but they are not good mothers, and seldom rear half their brood, where there are many hedges and ditches in the neighbourhood; they likewise very frequently drop their eggs in the water, if not carefully watched and shut up when expected to lay. A hen answers better for a mother to ducklings thaa their natural one. Not less than a drake and two ducks should be kept.

Bees, too, should be kept by every cottager: they cost nothing but the hives; they are a constant source of amusement; and they are very profitable.

The Cow.—Poverty will never enter the dwelling of an industrious labouring man, supposing him to be constantly employed, at from 9*s.* to 12*s.* a week, if he can once obtain possession of an acre of ground at a moderate rent, and a cow, provided that it please the Almighty to bless him and his family with health. So numerous are the benefits derived from this inestimable creature, that no maa ought to rest satisfied till he has accomplished the object of what ought to be his constant and unceasing endeavours. A good cow will supply a large family with milk and butter (and a great deal of the latter to spare) for 40 weeks, and with cheese all the year round. One cow has produced 217 lbs. of butter in 39 weeks. But

* *Succory*, or wild endive, forms excellent food for rabbits; the tops, blanched, either by covering with pots, or by planting in sand in a cellar, make an excellent spring salad, much used in Germany; while its roots, and also those of the dandelion, form one of the best substitutes for coffee. Dr. Howison of Edinburgh prefers dandelion coffee to that of Mecca; and many perons, all over the Continent, prefer a mixture of succory and coffee to coffee alone. Dig up the roots of dandelion, wash them well, but do not scrape them; dry them, cut them in bits, the size of peas, and then roast them in an earthen pot or coffee-roaster of any kind, and grind them in the coffee-mill, or bruise them in any way. The great secret of good coffee is to have it fresh-burnt and fresh-ground.

suppose an ordinary cow to produce 180 lbs., and allow 80 lbs. for the use of his family, and no cottager's family ought to use more, there will then be 100 lbs. to dispose of, which, at 8*d.* per pound, gives upwards of three guineas at once, ready to pay the rent, or to buy a couple of pigs; for a man who keeps a cow should never have less than two pigs in the sty. A cow produces a great deal of wash for the hog-tubs; there is the washing of the milk bowls twice a day; whey three or four times a week, for a skimmed-milk cheese should be made twice a week, while the milk is plentiful: if the *curd* is made while the milk is sweet, it will keep well for three or four days, with a little salt sprinkled over it, and covered with a cloth, in a cullender. Twice a week there will be the washings of the butter and churn; and the children will drink the buttermilk. Besides, the refuse of everything connected with a dairy becomes an excellent ingredient in the hog-tubs.

Breed of Cows.—The most profitable breed for cottagers is perhaps the Scotch or Irish, as they are more hardy, and can live upon coarser food than the higher breeds of cattle can. Their milk is rich, and yields a quantity of cream, and they are never dry so long as the larger breeds, which makes them the more valuable to a poor man. The Alderney give a great quantity of milk, and exceedingly rich cream, but are not hardy, and they require very good food, which makes them unfit for a cottager, except in the most southern parts of the kingdom.

To find food for this very valuable animal becomes the next consideration.

Besides having a comfortable, dry, fern-littered cowhouse, either to take shelter in or to be tied up in, a cow should at all times, especially after calving, be abundantly supplied with food, and with as much water as she likes to drink. Now, to effect this, and to produce vegetables for a family of 8 or 10 persons and a couple of pigs, not less than an acre will be required; and this acre of ground should be divided as follows:—

$$1 \text{ acre} \begin{cases} 80 \text{ rods of grass-land.} \\ 40 \text{ do. mangold wurzel.} \\ 40 \text{ do. kitchen-garden.} \end{cases}$$

Let the 80 rods of grass-land be carefully cleaned of nettles, docks, thistles, and broad-leaved plantains; let it be yearly well manured with coal ashes, soot, and road-scrapings, &c., for it must be mown every year; and, to make it produce as much as possible, the cow should never be allowed to graze upon it in wet weather, or after the 1st of March. By this plan it may be expected to yield upwards of half a ton of dry hay annually, beside the aftergrass. A portion of this hay or grass, or both, should be given daily: it will be found to correct any disposition in the cow to *scour:* the hay will be found particularly useful in the calving-season, or in sickness at any time.

Mangold Wurzel, although too opening to be the only food, should still be the principal article of food for the cow. Let 40 rods of it be sown towards the beginning of April, or any time between then and the end of June; two or three seeds being dropped into holes made by the dibber, in rows two feet apart, the holes being 12 inches asunder in the rows. This root requires good, strong, rich land: it must be well dug, and, when the plants are up, well mattocked, and kept clean: or, again, it may be sown in broad-cast, the seed being covered to the depth of an inch only, and as soon as the plants are the size of a goose-quill, they may be transplanted in rows of 18 in. distance, and 18 in. apart one plant

from the other. In transplanting, the root is not to be shortened, but the leaves cut at the top; and, in planting, let the upper part of the root appear about half an inch above ground. In the seed-bed keep them clear of weeds: when planted out, after once hoeing, they will suffocate every kind of weed near them. The produce will seldom or never fall short of 10 tons, being a supply of 1 cwt. a day from October to May, and leaves in abundance may be gathered in September and October, leaving 4 months out of the 12 to be supplied with cabbages, greens, &c.

It has been said that a cow will only consume 1 cwt. of fresh vegetable food in a day; but some cows will eat more than double that quantity. However, as 40 rods of mangold wurzel is a fair proportion of this excellent root (which is greatly superior to the Swedish turnip for a milch cow), we must contrive to have the same quantity yearly, by changing the ground, which may thus be effected:—In October, as soon as the leaves are cleared away to the extent of 20 rods, dig up the roots, and pit them in a dry situation, and immediately dig and plant the ground with early potatoes, according to directions in the next Chapter. This crop of potatoes will be succeeded by turnips and cabbages; and 15 or 16 rods of the latter will supply (including the first and second cuttings) upwards of 40 cabbages a day for the remaining four months, forming a regular and an abundant supply the year round. In cropping ground, it certainly is a good rule not to crop two seasons following with the same vegetable; but this rule must occasionally be violated, when we take into consideration the paramount necessity of a constant succession of crops to produce the greatest possible quantity of food from a limited space of ground. This necessity will justify the adoption of the following rule; viz., never to suffer a square yard of ground to lie a day idle during the growing season. The remaining 40 rods of garden-ground may be managed as directed for 20 rods, growing, of course, more potatoes and cabbages in proportion than anything else.

The time that should be allowed for mowing the grass, ricking the hay, and cultivating the ground, should not, on any consideration, exceed a week, viz.:—1 day (two halves) to mow and rick; $3\frac{1}{2}$ days to dig the ground, and sow the mangold wurzel seed; half a day to clear, dig, and plant 2 rods of ground with early potatoes; half a day to clear and pit the remainder of the mangold wurzel.

All the other cleaning, digging, cropping, &c., most assuredly ought to be done by the cottager, with the assistance of his children, at nights and mornings. His wife will have enough to do to manage her household affairs, her dairy, her pigs and fowls, and milking the cow, and, with the help of the boys, foddering her too.

Chapter IV.

THE GARDEN.

Before we enter upon the cultivation of the garden we must discuss a little more fully the subject of *Manure*, which has been mentioned already very frequently.

Manure.—A very great deal of manure may be collected from the road and lanes. A pit should be sunk and puddled near to the privy, unless the cottage has been built according to the plan already recommended (see pp. 17 and 26). In this all soapsuds and other refuse should be preserved. The privy manure is very useful, when mixed in a compost. Quite sufficient manure may be collected in this way for a cottage-garden of a quarter of an acre. The pig and poultry will make as much dung as will manure ground sufficient to grow pota'oes to supply the family a year; and any farmer will gladly let ground to a cottager for that purpose, rent-free, for the sake of the effect of the dung on the succeeding crop.

Management of Manure.—The manure may be procured from the pigsty, the cleanings of the rabbit-hutches, and the litter of the garden, all of which should be collected into a pit, and covered with a layer of earth to prevent the escape of the gaseous part. Care should be taken to throw a layer of earth over every additional quantity of manure; and if a little lime or salt could be afforded, and strewn over it beneath the layers of earth, the rotting would be quickened, and the quality of the dressing greatly improved. Manure may also be increased by collecting dead leaves, which are abundant in autumn, wherever there are hedges or trees. For the reception of the manure, it will be requisite to have two pits, otherwise part of it will become too rotten before the other is fit for use. If possible, these should be situated adjoining the pigsty, in order that the drainage from thence, and the cleanings of the sty once a week, and the spillings of the food, may not be wasted. Into these, too, the soil from the privies should drain, and all water, soapsuds, and slops from the house, should be emptied. Let any person try the experiment of watering with liquid manure but for one season, and he will soon find out its value, if he diligently water his cabbage-bed, by alternately emptying the cesspools. This must be done alternately, because the liquid manure is improved by time. If any person wishes to have a few early cabbages, let him apply liquid manure in abundance, and he will seldom fail of having a dish of cabbages a month before the usual time, if the plants are managed as will be hereinafter directed.*

Cultivation of the Garden.—We will now proceed to show how 20 rods of ground may be cultivated so as to produce vegetables enough for a man, his wife, and two or three small children (for, for every child above 4 years of age to 7, 2 rods of ground ought to be added); besides enough, with the stale wash and barley-meal, to keep a pig, fowls, and ducks, all the year round.

* See the article on Flemish Husbandry in the "Farmer's Series," pp. 20—22.

We will divide the garden in the following manner:—

20	1 Rod of Onions and Leeks will produce	3 bushels.
	½ do. Carrots	2 ,,
	½ do. Windsor Beans	3 ,,
	1 do. Parsnips	2 ,,
	3 do. Cabbages, with a row of Scarlet Runners to be planted round the edges	525 cabbages.
	4 do. Early Potatoes being upwards of 4½ lbs. from the middle of June to October, for each day.	480 lbs.
	4 do. Prussian Potatoes 6 do. Devonshire Apple Potatoes.	2410 lbs.

Which will afford 5 lbs. a day from the beginning of October to the middle of June, for the use of the man and family, being 258 days; and 13 lbs. a day from the 1st October to Christmas, for the pig, 86 days: the whole amounting, by this calculation, to 2408 lbs., or 40 bushels; or 640 bushels, of 60 lbs., per acre.*

The ground must be good, well manured, and well managed, to produce the above crops. Let us now see how this is to be effected, which will be no difficult matter if the following details be attended to:—

Onions may be cultivated for many years on the same ground, when properly manured, without failing to produce a good crop. In exposed situations, they should not be sown early, as they are generally hurt by frosty winds; and, if this should happen when they are from 4 to 6 in. long, they seldom turn out well. Perhaps the grub in onions is often brought on by injuries of this kind. Onions protected on the most exposed side, by pea-stakes or bushes, from being injured by frosty winds in the spring, have escaped disease in the summer; while others in the same bed, that were damaged by the wind, were entirely lost. If the manure is not plentiful, let it be pointed in just below the surface. A quantity of hens' dung should have been saved, and it may be sown moderately thick on the beds, either before or after the seeds are sown, or after covering the beds out of the alleys. Pigeons' dung and the dung of poultry should be collected with great care: in some places more is thrown away than would manure a large garden. The ground having been previously well dug, sow the seeds broad-cast in March, and edge the beds with a row of leeks, for no ground must be lost. It would be desirable to sow a small plot of onions early in August, to draw green in the spring; and such as do not run to seed will make fine heading onions in June and July. A pinch or two of the yellow Florence or Bath Cos lettuce, with a few scarlet-topped radish-seeds, may be thrown in with the onion-seed, to serve for a treat during the hot weather. The seeds should be sown thick, to have plenty of scallions to thin out; and a dozen onions, planted in the autumn or winter, in a warm situation, will always produce seed in abundance. Half a dozen leeks may be left for the same purpose.

Carrots do not require much manure, and are not so liable to be eaten by the slug when sown in April, as they are when sown a month earlier. The seed should be sown in drills, 9 inches apart, very thick, so that they may be thinned out for the pot twice or thrice a week during the summer.

* This calculation is perhaps too high, allowance being made for bad seasons and unforeseen accidents. If 15 rods were allowed for growing these 40 bushels, this would still be at the rate of 420 bushels per acre, which is a very good field crop. It is true, nevertheless, that Mr. Knight has grown at the rate of 600 bushels of 82 lbs. which is 890 bushels of 60 lbs., per acre.

The crop should be dug up the moment any maggots make their appearance, no matter how early, and pitted. The best method of destroying the worm in carrots is by watering between the rows; in June, with sea-water; a large garden potful to about 9 or 10 yards a row; after which, a watering of common water, from the rose of a pot, will be useful to wash the tops: this to be done in the evening in a dull day. In all probability lime-water would have the same effect. Half a dozen roots planted in the spring will always produce more than enough of seed; but a little of the early short-horn carrot-seed should likewise be sown for an early supply: the cottager would find his advantage in so doing. However, let him never try to save seeds of both sorts in one season.

Windsor Beans cannot well be planted too early; but the best time to insure a crop is the latter end of January or the beginning of February; and, if well managed and carefully looked after, that is, if they are manured, hacked, earthed up, and the insects destroyed as they appear, a rod of ground planted with broad beans will, with a bit of bacon, afford many an excellent meal; but, if the Cottager live in a coal country, let him beware of using too freely the coal ashes about his beans or scarlet runners, for they are poisonous to both as well as to peas; indeed they are not of much value as a manure, except on grass land: but they do the least harm to onions and potatoes in the garden: wood and peat-ashes, on the other hand, are an excellent manure. Windsor beans are generally dear at the seed-time, so, as a matter of course, a cottager will save his own.

Parsnips should be sown in March, in drills 18 inches apart, and left from 6 to 9 inches apart in the row. This is an excellent vegetable, and will be found useful all the winter: indeed, some people think them better for having had a sharp frost or two upon them. Be that as it may, when the crop is taken up they should not be *pitted* very close, else they will heat and rot: avoid this, and any place free from rats and mice will answer the purpose. Three or four roots, planted early in the spring, will yield plenty of seed.

For *Cabbages*, three rods of ground will afford upwards of 500 the first cutting, and double that quantity during the summer and autumn; considerably more than half of which together with the leaves will go when boiled into the hog-tubs, forming altogether no trifling quantity of food for the pig.

To make sure of an early crop of cabbages, the seed should be sown about the middle of July and the first week in August, of the Fulham kiad; but be sure to get a good sort, for there are numerous varieties. Prick out the seedlings as they advance in growth; and finally plant out for the winter the first sowing in the last week in August, and the second sowing in the last week in September. The prickings-out and final transplantings may all be done on the ground, which is now being daily cleared of early potatoes. The sugarloaf and drumhead cabbage-seed may be sown in August, and left in beds to be planted out in the spring, where and whenever a corner can be found for them. A few seeds of the early York and sugarloaf may be sown likewise in the spring, to fill up with, or even to plant whole rows, as it may appear necessary. If, towards the winter, the plants of the first sowing appear very strong or topheavy, a little earth may be drawn about them to keep them steady; but it is not a good method to earth up cabbage-plants before winter, unless they are *very early*: it enables the slugs to get to them with greater ease; it is apt to make them long-legged, and, what is worse, *late in cabbaging*. Cabbage-

plants should always be transplanted in dry weather. Two or three of the best may be marked when cut, and left for seed.*

French Beans or rather scarlet runners may be planted in the middle and latter end of April, with great advantage, round the cabbage bed: they will benefit rather than injure the crop, and need not take up more than a few square yards of ground. They should be staked early, and carefully protected from the frost. A second sowing in the latter end of May will be found of great service when the first sowing has become nearly unproductive. In dry and airy situations scarlet runners should not be allowed to run more than 5 ft. high: they will break out below, and bear plentifully. But if the ground is wet, and much sheltered, they will bear better by allowing them to run 7 or 8 ft. Seeds are always abundant.

If sticks are scarce, sow the scarlet runners 18 in. apart, stopping the runners as they advance; and, by this means, they will bear most abundantly till the frost destroys them. If they are to be supported by sticks, sow them in lines in different parts of the garden, as they bear more abundantly when detached from other plants. This is a very useful vegetable; and if preserved in the German manner, by salting, like sauerkraut, these and many other vegetables will be rendered of great value to the cottager.

When sticks cannot be got, strings will do. Stretch a strong string, or a straw rope, horizontally, 7 or 8 ft. above the row, supporting it by a stick at each end; and at every 10 or 12 ft. distance stick a peg in the ground at the root of each plant, and from that stretch a string to the horizontal cord above.

Early Potatoes.—To have a crop of potatoes very early, plant ash-leaved kidneys, whole, about the middle or beginning of October, in drills 9 in. deep, well covered with muck, 8 in. apart, and 14 in. between the rows: they will be full a fortnight earlier than if the planting be delayed until February, and will be quite ready by the middle of June. An excellent crop of radishes may be grown on the same ground, for the mould should be left as light as possible above the potatoes; and, if radish seed be sown in the beginning of January and covered over with some straw or long litter, to preserve the seeds and plants as they come up from the birds, (protecting them, of course, in severe weather,) by a little extra diligence, 10*s.* to 20*s.* worth of radishes may be raised out of this small plot of ground.

By the Lancashire mode of raising early potatoes, which seems particularly suitable for the colder parts of Britain, they are generally ready about the beginning of May. Mr. Saul of Lancaster says, "Put the potatoes in a room, or other convenient warm place, in January; about the 2nd of February, cover them with a woollen cloth for about four weeks, then take it off, and by so doing you will make the sprouts much stronger. Towards the latter end of March set them, covering the sprouts about 2 in. deep. If the sprouts be about 2 in. long when set, the potatoes will be ready in 7 or 8 weeks afterwards." The sets of the extreme end of the potato are found to grow faster, and ripen about a fortnight earlier than those from the root end. In Lancashire, therefore, the sets from the two ends are separated; and, if planted at the same time, from an early and succession crop.

* A cottager might often make a few shillings by saving seeds, and selling or exchanging with his neighbours, or with the seedsmen. In different parts of Scotland this is done by labourers, weavers, and other mechanics. Torrieburn is, or used to be, famous for its seeds of German greens; another village near Stirling, for leek-seed; Dunfermline and Paisley were also noted in this way; and what are called the Russian stocks are raised from seeds saved by the weavers of Silesia and Saxony.

In Denbighshire, the potatoes intended for seed for the following year are taken up before they are ripe, just when the outer skin peels off, and before the stalk or stem begins to wither: they are laid upon a gravel-walk, fully exposed to the sun, for a month or six weeks, when they become quite green and soft, as if roasted, and often much shrivelled: they are then put away, and protected as other potatoes are. In February they are examined, when every eye is generally found full of long sprouts fit to be planted. Only two sets are made of each potato, the eye or top part, and the root or bottom part. They are separated as in Lancashire; and, when planted in the common ground, the eye or top sets are earlier by a fortnight than the others. They are generally fit to gather before the middle of May.

In the middle of June begin to dig a few potatoes daily, always remembering to bury the tops; and as soon as half a rod is cleared, let it be sown immediately with some Dutch or six-week turnip seed: let the same be done with the next half rod.* The middle of July will now approach, and this is the time to sow Fulham Cabbage-seed; for which there will be plenty of ground, not only for sowing but for pricking out; and, finally, the whole three remaining rods may be planted with the cabbage-plants, which will finish cropping the ground from which the early ash-leaved kidneys have been dug. However, in this piece of ground, when the first cabbage-seed is sown, some seed of the common rape should be sown for winter and spring greens; they are very good and very productive.

Late Potatoes form an important crop to the cottager; for upon this he relies for a supply both for himself, his family, and his pigs, so that no trouble must be spared in digging and manuring the ground.† All the scrapings, the mixture, and pig's litter will now be found necessary; for, from these ten rods of ground, 10 sacks of potatoes, each weighing 240 lbs., must be obtained. Two sorts may be planted as follows:—Some time early in April plant 4 rods with the Prussian potato; it is an excellent sort. It is productive, and, if necessary, it keeps well; although it is quite fit to eat after the early sorts are over, being intermediate between the early and late ones. These should be planted (*single eyes*) 7 or 8 inches apart, in rows 18 in. asunder. They will be ripe, and must be dug up in the beginning of September, whether they are wanted or not; and immediately plant the whole four rods with the rape plants above mentioned. The remaining 6 rods of ground may be planted the first week in May, with the Devonshire apple, or Prince's Beauty potatoes: both red, and excellent sorts. Plant *single eyes*, cut from prime potatoes (as all single eyes should be), the same distance as directed for the Prussians, unless the ground should be wet; in which case, 2 ft. between the rows will be preferable: but, at whatever time potatoes are planted, in all cases, as soon as the plants show their heads, let the ground be well moved about them; that is, hacked with a light mattock. This will destroy the weeds, and cause the plants to grow rapidly, till it is time to earth them up, which should be done when they are about 6 in. high. This operation, with the

* The fly is very hurtful to the turnip. Common soot dusted over the plants infested, afterwards giving them a good watering, has banished every appearance of fly from them in a very few days. The cottager may consider the appearance of the turnip fly as the appearance of a crop of weeds: let him, therefore, dig down the whole, and sow again immediately. Before a second crop of flies can appear the seed must be sown; that is, the eggs deposited; and this is not very likely to be the case.

† The richness, the quantity, and the healthiness of his crops will depend on the abundance and judicious application of manures; the complete rooting out of weeds; regular, deep, and repeated forking; a careful choice of seeds for sowing; and, as far as his confined space will admit, a proper rotation of crops.

previous "hacking," if done in fine dry weather, will most effectually destroy the weeds for the season.

During the summer months, let the ground be deeply and frequently hoed among all the crops, particularly during dry weather, whether there are weeds or not. With deep and frequent hoeing less manure is more useful than a great quantity of manure without hoeing. No plant is so much improved by deep pronging or mattocking between the rows as the potato. With this treatment it will grow most vigorously in the driest weather, and in a very poor soil.

Potatoes, after being washed, may be put on to boil in cold water without being peeled. When half done, the water may be poured from them, and fresh cold water added, which is also to be poured away when they are boiled sufficiently. They are then to be left by the fire to dry for a short time, before the skins are taken off, and will be found more floury when boiled in this way than when the water is not changed. This quality, so valuable to those who make the principal part of the meal off this vegetable, and which renders them a better substitute for bread, may be considered as making amends for the greater length of time taken in cooking, and, consequently, larger consumption of fuel. The Lancashire mode of cooking potatoes is as follows:—Brush off the skins, set them on the fire in cold water: when boiled, pour off the water completely, add a little salt, and dry them well on the fire.

Indian Corn.—By way of experiment, a handful or two of Cobbett's dwarf Indian Corn may be planted, in the latter end of April, round the edges of the potato plot, or against a fence with a warm aspect; but the corn must be planted considerably thicker than Mr. Cobbett recommends. In order to produce a crop worth growing, 9 or 10 inches in the row is wide enough; and, as single rows only can be grown in this case, the corn might even be planted thicker. On dry, warm, sandy soils south of York, Indian corn will ripen well. It is good for fowls, and excellent for fattening pigs; but it must not be given in too large quantities at a time to the latter, for it is of a very heating nature. At Sandy, in Bedfordshire, it produced, in the very unfavourable season of 1829, at the rate of 105 bushels per acre, equal to 3 tons of good meal for feeding stock. Wheat, barley, peas, or beans, will not average 15 cwt. of meal per acre.

Fruit-Trees have been entirely omitted, because, upon the whole, a small garden is better without them. However, let the cottager train against his cottage currants, gooseberries, cherries, apples, pears, or any sort of fruit-tree he can procure, likely to thrive. The roots of the hop may be brought from the hedges, and planted in corners of the garden: their tops are very wholesome, and are as tender as asparagus; they climb and make a good summer-house. The cultivation of a few Brompton and ten-week stocks, carnations, picotees, pinks, and other flowers, ought never to be omitted: they are the means of pure and constant gratification which Providence has afforded alike to the rich and the poor.

These flowers and prize gooseberries are great sources of amusement to the Lancashire and other weavers and mechanics. We would wish to see fruit-trees, ornamental shrubs, climbers, and flowers in every cottager's garden, with bees, poultry, rabbits (if only for the children), pigeons and a cat.

In doing the work necessary to crop and clean a garden of 20 rods of land, no labouring man who has regular employment, from six to six o'clock in summer, and from light to dark in winter, ought to lose one hour; and, the man who would require to be taught the second year how to crop his ground, would require it all his life. No person can go wrong if he but change the crops as much as possible in rotation, and if the ground

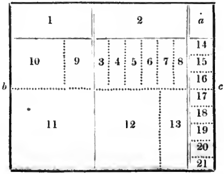
is of greater extent, the same proportions of different vegetables will hold, potatoes and cabbages being always considered the most important crops.

In concluding these remarks, it may be observed that a labouring man and a small family (probably from the want of other vegetables and of good bread and meat) usually consume a greater quantity of potatoes than is here allowed. But if a man has 14 score of bacon every year, this alone will afford him upwards of three-quarters of a pound for every day, a greater quantity than 99 poor families in 100 have throughout the country; and most men will prefer a good slice or two of boiled bacon, cabbage, carrots, and good wholesome bread and ale, to a quantity of potatoes. Fifty perches of land, exclusive of that occupied by the buildings and pigyard are sufficient to supply every requisite kitchen vegetable, including potatoes, to a labourer's family, and to his live stock; the former consisting of two grown persons and four children, and the latter, at an average, of one pig, three rabbits, three hens, and three ducks. This quantity of land will be found enough in a stiff soil; but if, on the contrary, the soil is rich and light, a less quantity may be found sufficient, and will certainly be more advantageous to the labourer in every respect, as it will require less time to be bestowed on its cultivation, and yield earlier and better crops.

It may be useful to go into the details of the management of the garden; and the following plan of rather more than a quarter of an acre is given, with precise directions for the management of it. To these are added similar plans for cultivating either the same space or larger quantities of ground; so that by a comparison of them the cottager may select which best suits his inclination, or his soil, or his wants.

No. 1. *Potatoes and Radishes*, 19 yds. long by 4½ yds. wide. Quantity of seed and price: 2 galls. potatoes, 6*d.*; radishes, 1*d.*

Plan 1. 35 *yards by* 40.



In the last week of February take 6 barrows of manure, spread it regularly over the ground, and commence digging at one end for 1 foot. Then stretch the line across the border, and cut down a trench 3 in. deep, and plant the early frame potato at 9 in. distance in the row; then dig again for 18 in., set the line, make a trench, and plant as before. Continue this for 7 yards; then dig and rake the remaining 2 yards, and sow the short-topped radish, which may all be done in 6 hours; or in 3 days, at two hours each day. The potatoes will require hoeing in the beginning of May, half an hour; earthing up in the middle of the month, 1 hour. They will be ready for use by the end of May, and will serve the family until the end of August. Radishes ready in April.

No. 2. *Early Peas and Beans*, 18 yds. by 4½ yds. Peas, 3 pts. 1*s.* beans, 1 pt. 2*d.*; pea-sticks, 6*d.*

In the beginning of January dig all the ground, and then sow 14 yds. with early frame peas, at 3 ft., from row to row, and the remaining 4 yds. with Mazagan beans, in rows, 1½ ft. asunder, taking 4½ hrs. work. They will require twice earthing up: first in February, then in March, a quarter of an hour each time. The peas must be sticked in March, which will take half an hour. After that, they will only require being kept clear of weeds, and will be ready for use from the latter end of May to the end of July.

No. 2 *a*, is reserved for sowing small seeds, as shall be afterwards explained.

No. 3, *Early Barnes Cabbage*, 9 yds. by 11½ ft.

In the middle of October spread regularly 4 barrows of manure, and let it be well dug, which will take 3 hrs. work; then plant in rows 1½ ft. asunder, and 1 ft. in the row, 200 plants, half an hour's work. For the raising of the plants, see No. 2 *a*.

No. 4. *Dwarf Marrow Peas and Windsor Beans*, 9 yds. by 11½ ft. Peas, 1 qt. 8*d.*; beans, 1 pt. 2*d.*; pea-sticks, 6*d.*

In the middle of February, dig and sow 2 rows of dwarf marrow peas, 4½ ft. distant; and 2 rows Windsor beans, 2 ft. distant, 1½ hrs. work; earth up and stick the peas the beginning of April, 1 hr. They will be in use from the end of July to the beginning of September.

Nos. 5, 6, 7, and 8, must have 6 barrows of dung, and be well dug in the beginning of March, 4 hrs. work.

No 5, *Onions*. 1 oz. seed, 6*d.*; produce, 2 bushels; 27 ft. by 5 ft.

Rake it level; then stretch the line, and draw drills half an inch deep, and at 6 in. distance. Sow the seed; then rake it gently over, 1 hr. work. When the seeds come up, and are fit for eating, thin them out to 3 in. distance; keep clean all summer: they will be ready for pulling up the latter end of August.

No. 6, *Prickly Spinach*, 6 ft. by 27 ft. 1 oz. seed, 2*d.* Ready in June.

Rake the ground even, and sow broad-cast in March, half an hour; after they are come up, thin out to 4 in. every way, and keep clear from weeds.

No. 7, *Early Turnip, and Bath Cos Lettuce*, 7 ft. by 27 ft. Seed, turnip, 1*d.*; lettuce 1*d.*

Rake it level, and sow at the latter end of March, half an hour's work. Thin the turnips in April to 9 in.: they will be ready in May. Thin the lettuce in May to 9 in., and they will be ready in June. They must be kept clear of weeds.

No. 8, *Scarlet Runners*, 30 ft. by 9 ft., 1 pt. seed, 3*d.*; sticks, 6*d.* Ready in July, and in season till destroyed by frost.

Lightly dig the ground in the beginning of May, and plant 2 rows of scarlet runners at 3 in. distance in the row, 1 hr. work; earth up and stick when 3 in. high, half an hour.

Nos. 9 and 10. Dig in January and February, which will take 10 hrs.

No. 9 *Parsnips*, 6 yds. by 9 yds. Seed 2*d.* Ready for use in October. Sow in February, in drills 1½ ft. asunder, and 1 in. deep, 1 hr.; keep clear from weeds, and they will be ready to take up in October, 2 hrs. work. Produce, 4 bushels.

No. 10, *Carrots*, 14 yds. by 9 yds. Seed, 4*d.*; produce, 12 bush.

Lightly dig the ground, and sow in drills 1 ft. distance, and half an inch deep, the first week of March, 2 hrs. work. Thin out where too thick, from 4 to 6 in. distance; keep clear from weeds, and they will be ready to

take up in October. Then they must he taken, with the parsnips, into the open shed, and covered with straw, to exclude the frost, 3 hrs. work. From *b* to *c* plant a row of gooseberries, red, black, or white currants, as each of these will be useful in summer for pies or puddings.

No. 11, *Barley*, 19 yds. by 20 yds. Seeds, 1½ gal. 1*s*. 3*d*.; produce, 4 bush.

The ground must be well dug in November, 12 hrs. work; then let it lie until the last week of March, when it must be lightly dug, and the barley sown in drills, 6 in. distance, and 1 in. deep, 6 hrs. work. After it has been up three weeks, it must be rolled or beaten with the spade, 1 hr. Nothing more will be wanted till hoeing time, which may be performed in 1 hr. It will be ready for reaping in August, 2 hrs. If the weather be unfavourable, take into the shed to dry; thresh in October, 5 hrs.

No. 12, *Potatoes*, 19 yds. by 15 yds. Seed, 1 bush. 1*s*. 6*d*.; produce, 25 bush.

Dig the ground in December, 10 hrs. work. Let it lie until the first week of April; then spread 8 barrows of manure on it, and commence lightly digging at one end of the piece. Stretch the line at 1 ft. from the edge; cut down a trench 4 in. deep, and plant the potatoes. Then dig for 3 ft. more, set the line, and make a trench, and plant as before; and so on to the end of the piece, 7 hrs. work. About the latter end of May they will require hoeing, 2 hrs. In a fortnight they must be earthed up, 1 hr.; and the final earthing a fortnight afterwards, 1 hr. They must be kept clear of weeds until October, when they will be ready for digging up, 8 hrs. To keep potatoes, make two holes, 1 ft. deep and 4 ft. diameter, which will hold 8 bushels each; lay some straw over them; then cover up with soil 1½ ft. thick. The remaining 9 bushels may be put in the shed, and covered with straw for use.

No. 13, *Sugarloaf or large York Cabbage*, 19 yds. by 5 yds.; 220 plants. For the raising, see No. 2 *a*.

Dig well over in December, 2 hrs. work; then, in March, lightly dig in 3 barrows of manure, 2 hrs. work. Plant in rows 2 ft. distant, and 1½ ft. in the row, 1 hr. Earth up in April, half an hour. They will be ready in July.

Nos. 14 to 20, must be well dug in January, 4 hrs. work; then, in March, they must be planted in beds with chamomile, hyssop, sage, marjoram, and chives, which will be all useful as pot or medicinal herbs. Nos. 19 and 20 must be planted with balm and spearmint, which will serve as substitutes for tea in the winter months.

No. 21, *Mercury* (Chenopòdium Bònus Henricus), as a perennial spinach, will be found exceedingly useful. The roots may be taken out of the fields in September and planted, 1 hr.; and they will yield a sufficient supply the next spring, and throughout summer. The other herbs must be planted in the beginning of April, 3 hrs.

No. 2 *a*, as before mentioned, is reserved for raising seedlings, &c. In the last week of February, sow about 2 sq. yds. of Savoy cabbage, a quarter of an ounce; likewise 2 yds. of green curled borecole, or Brussels borecole, a quarter of an ounce, 1 hr. work: and as the potatoes come off No. 1. the Savoy and borecole may be planted in rows 2 ft. asunder, in July or August, 2 hrs. work. Then sow in No. 2 *a*, in the first week of August, half an ounce of early Barnes cabbage, 6*d*.; transplant in any vacant piece of ground, in September, at 3 in. distance every way, 1 hr.; there to stand till finally planted in October in No. 3. Likewise, about the middle of August, sow half an ounce (6*d*.) of the large York or large sugarloaf cabbage, and transplant in September, 2 hrs., in any vacant ground, where they will have to stand till March, to be planted in No. 13.

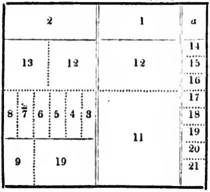
Leeks.—Sow in *a* No. 2, half an ounce of leek (2*d.*), in March, half an hour; for transplanting into No. 7, after the turnips have come off, 1 hr. A little lettuce may be sown, to transplant in May or June, and will be ready in August and September.

Cucumbers.—In the first week of May, between three of the rows of peas No. 2, dig a small place, 18 in. wide, and put in 8 or 10 cucumber seeds, which will come up and be sheltered with the peas, and, when the peas come off, will be fit for fruiting.

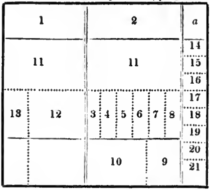
The next years of cropping must be changed as in plans Nos. 2 and 3; and, by so doing, a regular succession and rotation of crops will be maintained through the ground, always giving the same kind of culture to each individual crop in every quarter of the garden which has been pointed out.

Hoeing, weeding, and gathering the Vegetables must be done by the wife and children; every hour that is to spare may be devoted to some useful purpose in the garden.

Plan 2. *Second year's cropping.*



Plan 3. *Third year's cropping*



Having thus briefly stated the culture of those vegetables which are the most profitable to a cottager, we shall now present the whole in a tabular form, which might be hung against the wall in a cottager's kitchen; and

COTTAGER'S GARDEN CALENDAR.

Catalogue of Vegetables.	January.		February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		Dec.		Expense of seed.	Produce.	Number of Days which the produce will serve the Family, &c.
	work.	h.	work.	h.	work.	b.	work.	h.	work.	h.	wk	h.	work.	h.	work.	h.	wk.	h.	work.	h.	wk.	h.	wk	b	s. d.		
Potatoes	..	.	dig / plant	6	..	.	..	.	hoe and earth up twice	1½	rea	.	—	.	..	.	..	.	..	.	..	.	..	.	0 6	4½ bush.	26. Small for hogs, &c.
Radishes	..	.	sow	.	..	.	ready	.	..	.	..	.	..	.	..	.	..	.	..	.	..	.	..	.	0 1	20 l. bd.	For breakfasts, &c.
Peas and beans	dig / sow	4½	earth up	½	ear. up	½	stick ..	½ .	ready do.	.	— —	.	— ..	.	.. ..	.	.. ..	.	.. ..	.	.. ..	.	.. ..	.	1 0 0 6	7 pecks 8 pecks	7. 8. Pods for hogs.
Early Barnes cabbage	..		earth up	½	..	.	ready	.	—	.	—	.	..	.	sow	½	trsp.	½	man. dg. plt.	3½	..	.	..	.	0 6	200 cab.	40. Leaves for hogs.
Dwarf marrow peas Windsor beans	..	.	dig / sow	1½	ear up ..	½ .	stick ..	½ .	.. ..	.	.. ..	.	ready do.	.	— —	.	.. ..	.	.. ..	.	.. ..	.	.. ..	.	1 2 0 8	8 pecks 6 pecks	8. 6. Pods for hogs.
Onions	..	.	digging	4	sow	1	..	.	..	.	..	.	..	.	rea.	.	..	.	..	.	..	.	..	.	0 6	2 bush.	6. Slice to cold pork
Spinage					do.	½	..	.	..	.	rea.	.	..	.	..	.	..	.	..	.	..	.	..	.	0 2	..	6. Refuse for hogs.
Early turnip					do.	½	..	.	ready	.	..	.	..	.	..	.	..	.	..	.	..	.	..	.	0 1	..	5.
Lettuce					do.	½	..	.	..	.	rea.	.	..	.	..	.	..	.	..	.	..	.	..	.	0 2	..	6.
Scarlet runners					..	.	..	.	sow	1	stk.	½	—	.	rea.	.	—	.	—	.	..	.	..	.	0 9	..	60. A profitable crop
Parsnips	dig	10	sow	1	—	.	..	.	..	.	..	.	..	.	..	.	..	.	tk. up	1	—	.	—	.	0 2	4 bush.	8. 3 bsh. for hogs, &c.
Carrots			do.	2	..	.	..	1	..	.	..	.	—	.	..	.	—	.	do.	2	—	.	—	.	0 4	12 bush.	40. 7 bsh. for hogs, &c.
Barley	..	.	..	.	dg. so.	6	roll	1	roll	1	hoe	1	..	.	reap	2	..	.	thres.	3	dig.	12	..	.	0 9	4 bush.	For hogs and hens.
Potatoes	..	.	..	.	..	.	dg plt.	7	hoe	2	ear.	1	earth	1	..	.	..	.	tk. up	3	..	.	dig	10	1 6	25 bush	130. 8 bsh. for hogs, &c.
Sugarloaf cabbage	..	.	..	.	dg. plt.	3	earth	½	earth	½	rea.	.	—	.	sow	½	..	.	trsplt.	½	..	.	dig.	2	0 6	220 cab.	40. Plenty for hogs.
Savoy cabbage	..	.	sow	½	..	.	..	.	..	.	..	.	dg. plt.	1	..	.	..	.	..	.	..	.	rea.	.	0 3	160 cab.	30.
Green curled borecole	..	.	ready	.	sow	½	..	.	..	.	..	.	..	.	dg. plt.	1	..	.	..	.	..	.	..	.	0 3	100	20.
Cucumbers	..	.	..	.	..	.	..	.	sow	½	..	.	.	.	ready	.	—	.	..	.	..	.	..	.	0 2	90 cuc.	30.
Leeks	..	.	..	.	sow	½	..	.	..	.	..	.	..	.	dg plt.	1	..	.	..	.	..	.	..	.	0 2	..	Useful as potherbs.
Potherbs, &c.	dig	4	..	.	..	.	plant	3	—	.	—	.	—	.	—	.	—	.	..	.	..	.	..	.	1 0	..	Mint and balm dried
Mercury	..	.	..	.	—	.	—	.	—	.	—	.	..	.	..	.	plt.	1	..	.	..	.	..	.	...	..	for tea in winter.
Hours monthly		12½		15½		12½		13½		6½		2½		2		4½		1½		20		12		12	11 2		446 days.

As the calculation made of each day's consumption overruns the number of days in the year by 81, so if the crops were not quite so abundant, still there would be sufficient; and, with good management, they will exceed the calculation of produce; therefore a few shillings, to equal the expense of the seeds (11*s.* 2*d.*), may be made by selling the overplus.

It will be seen, in the foregoing table, that there is in no one week in the year above 5 hours' work to be bestowed on the garden, and in some weeks not 1 hour's work; so it should all be done without ever losing one day's labour.

Abbreviations.—h. hours; wk. work; ear. earth up; dg. dig; plt. plant; rea. ready; stk. stake up; trsp. transplant; man. manure; tk. take up; thres. thresh; bd. bundle; cab. cabbage; cuc. cucumbers.

would show, at one view, the work to be done, the time necessary for performing it, and the produce that he might expect from his labour, with good management.*

Plan 4 contains 2 acres: the part *a*, one-fourth of an acre, to be cropped the same as Plan 1, &c., except the sugarloaf cabbage, for which there will be no necessity in that place; *b*, for green food for cow; *c*, the pasture for the cow; and *d*, the meadow for winter food.

Directions for Cropping b.

No. 1, *Sugarloaf or large York Cabbage*, 11 yds. by 35 yds. Seed 1*s*.; produce 23 cwt. Manure with six harrows of manure, and dig the ground in January, 12 hrs. work; plant in February (having previously raised the plants in *a*, No. 2, as directed for first class, which part must be a little enlarged), at 1½ ft. distance in the row, and 2 ft. from row to row, 1100 plants, 2 hrs. work. Earth in March, ½ hr.; April, ½ hr. They will be ready in the middle of July, when they must be cut, and taken into the pasture (*c*); beginning with a small quantity, and increasing as the pasture decreases.

No. 2, *Turnips*, 24 yds. by 17. Seed, 2*d*; produce, 26 cwt. Dig in March, 12 hrs. work. Let it lie until the 20th of June, then lay on six barrows of manure, dig it lightly in, then sow 3 oz. of Tankard or Norfolk turnip, 7 hrs. work; hoe in July, 1 hr.; the same in August, 1 hr. Ready in November.

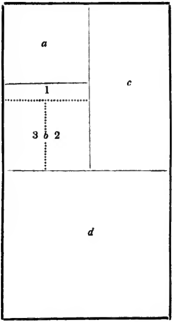
No. 3, *Drumheaded Cabbage*. Seed 1½ oz, 1*s*.; produce, 2 tons. The seed must have been sown in *a*, No. 2, the latter end of August, ½ hr., and transplanted in October, 1 hr. Sometimes the severity of the winter may destroy part of the cabbage plants; then sow again in the beginning of February, which will be ready for planting in May. Dig the ground well in February, 12 hrs.; then lay on six barrows of manure about the middle of April, lightly dig and plant, 6 hrs.; earth up in May, ½ hr.; the same in June ½ hr. Keep clear of weeds all summer, and they will be ready for use in February and till May.

Rotation of Crops.—After having given the rotation of crops of Plans 1, 2, and 3, it is unnecessary to say much more; but the crops as they stand in Plans 1, 2, or 3, of the first class, and in *a* of the second class, Plan 4, may be removed to *b*, Plan 4, by beginning with the barley, *a*, into 1 *b*, when 2 *b* will be removed to 3 *a*, and 3 *b* into *a*; and so a regular succession and rotation of crops may be obtained.

* Estimate of the Yearly Expenses of a Cottager and his Family, exclusive of Vegetables, Pork, and Eggs.

	£.	s.	d.
House and garden, rent per annum	3	12	0
Taxes, rates, &c. upon ditto	0	9	0
Coals and wood	3	0	0
Tea	0	18	0
Sugar	1	10	0
Butter	1	12	0
Bread, flour	11	10	0
Milk	0	12	0
Salt, pepper, soap, &c.	1	5	0
Man's shoes, clothes, &c.	3	0	0
His wife's ditto	2	0	0
Children's ditto	5	0	0
	£34	8	0

Plan 4. 40 *yards by* 140 *yards.*



Pasture Ground, *c*, half an acre. The cow to be turned in on the 12th of May, where there will be enough until the middle of July; then the sugarloaf cabbage must be begun with by cutting and giving them as the state of the pasture requires. They will continue until the 1st of October. There will be plenty of dung on the pasture ground.

Meadow Ground, *d*, 1 acre, produce 2 tons. About 20 barrows of dung must be laid upon one-third of the meadow ground every year in January, 4 hrs. work. Mowing may be begun in July, 12 hrs. work. The time of getting the hay depends on the weather, but to average one year with another, three days for the man, wife, and children will be sufficient; stacking, 1 day; thatching, ½ day. Turn the cow into the yard on the 1st of October, till the severity of the season obliges you to take her into the house, when the turnips will come into use; but as long as open weather continues turn her out in the day-time, giving in the field about 40 lbs. of turnips each day and about 4 lbs. of hay in the night-time, till she must be taken entirely into the house; then she must have 14 lbs. of hay, and 70 lbs. of turnips each day and night. After the turnips are done, begin with the drumhead cabbage, at 50 lbs. each day, with 18 lbs. of hay, increasing the quantity of hay and lessening the quantity of cabbage as the cow is getting dry, which will be about the middle of March; then let her have from 25 to 30 lbs. of hay each day, until she calves, in the latter end of April; she must then have plenty of hay, and the remaining part of the cabbage, until she is turned into the pasture on the 12th of May. The calf may be suckled ten weeks, and then it will be worth about 4*l*.

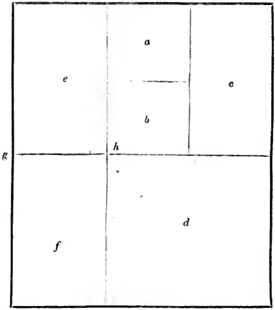
Plan 5. *e*. *Autumn Wheat*. 5 pecks, 8*s*.; produce, 15 bushels. Dig in May, 40 hrs. Let it lie until the last week of September; then light dig and sow in drills 6 in. distant, and 1 in. deep, 5 pecks of corn, which may be done in 25 hours. It must be well rolled in March, 2 hrs.; then in May it will require hoeing, 4 hrs.; after that it will want no more until ready for the sickle in August.

f, *Spring Wheat*. 6 pecks, 9*s*. 6*d*.; produce, 15 bushels. Dig in November, 20 hrs., and December, 20 hours; then let it lie till the last week of March; then dig, rake, and sow, broad-cast, 6 pecks of spring wheat, 20 hrs.; roll in April, 2 hrs.; weed in May, 5 hrs.; nothing more will be wanted till August, when the reaping of both *e* and *f* must be commenced, if ripe; which by the man, his wife, and children, may be done

in two days, or 24 hours. If the weather be unfavourable, take into the open shed to dry. An open shed is of primary importance to the cottager; for, if the weather is unfavourable for one week after he has cut his corn, his subsistence for the next twelvemonth is entirely wasted. Threshing may be performed at three different times, viz., September, 16 hrs., December, 16 hrs., January, 16 hrs. Keep some straw for the thatching of the haystack, and the rest may be sold, which will pay for the expense of the seed; or lay it out in dung, which will in the end be most profitable.

Rotation of Crops.—In the second year the crops of *a* and *b*, with the culture directed, must be removed to *f*, and *f* to *e*, and *e* to *a* and *b*,

Plan 5.



and the third year remove round again, so that in the fourth year it will be again the same as Plan 5, by which rotation good crops may be produced.

From *g* to *h* may be planted a row of gooseberries or currants.

By the following table it will be seen, that as the labourer's comforts and means of getting his livelihood are increased, he will become a more profitable member of society; for the benefits resulting from keeping a cow are still greater if he can grow his bread-corn.

It would thus appear that a man in possession of 3½ acres of land, by bestowing on it 186 hours of labour in the course of the year, may maintain himself and family. This labour, with the exception of three weeks, may be performed wholly as a recreation during leisure hours; but, if the object can be attained with so small a quantity of land, and even double the number of hours' labour, it affords a gratifying prospect of the

TABULAR ABSTRACT OF THE THREE CLASSES.

	January.		February.		March.		April.		May.		June.	
	work.	h.	work.	h.	work.	h.	work.	h.	work.	h.	work.	h.
1st Class . . .	..	18½	..	15½	..	12½	..	11½	..	6½	..	3½
2nd Class . . .	..	16	..	14	..	12½	..	6½	..	½	..	7½
3rd Class . . .												
Autumn Wheat	..	.	..	.	..	.	..	.	dig	40	..	.
	..	.	..	.	roll	2	..	.	hoe	4	..	.
	thresh	16	..	.	..	.	..	.	..	.	..	.
Spring Wheat . .	..	.	..	.	sow	20	roll	2	weed	5	..	.
		50½		29½		47		20½		56½		11

	July.		August.		Sept.		Oct.		Nov.		Dec.		No. of hours.	Annual expenses	Annual earnings	In hand for necessaries
	work.	h.	work.	h.	work.	h.	work.	h.	work.	h.	work.	h.		£. s. d.	£. s. d.	£. s. d.
1st Class . . .	..	2	..	4½	..	1½	..	20	..	12	..	12	120	34 0 0	35 4 0	0 16 0
2nd Class . . .	..	67	..	2	..	2	..	.	..	.	..	.	128	35 4 0	41 19 2	6 15 2
3rd Class . . .																
Autumn Wheat	..	.	..	.	sow	25	..	.	..	.	..	.	65	26 2 6	40 2 4	13 19 10
	..	.	..	.	..	.	..	.	..	.	..	.	6			
	..	.	..	.	thresh	16	..	.	..	.	thresh	16	48			
Spring Wheat . .	..	.	..	.	..	.	..	.	dig	20	dig	20	67			
		69		6½		44½		20		32		48	434			

EXPENSES.

	£.	s.	d.
House and Land Rent	7	10	0
Rates, Taxes, &c.	0	18	0
Fuel	3	0	0
Tea	0	8	0
Sugar	1	0	0
Grinding of Corn	0	15	0
Seed corn	0	17	6
Salt, Pepper, Candles, &c.	1	14	0
Clothes, shirts, &c.	10	0	0
	£26	2	6

RECEIPTS.

	£.	s.	d.
Labourer's Wages, at 12s. per week, allowing three weeks at home	28	16	0
Wife, one month's work	1	0	0
Calf	4	0	0
Butter	5	0	0
Chickens	0	18	0
Eggs	0	8	4
	40	2	4
Deduct expenses	26	2	6
	£13	19	10

comforts and enjoyments that humane and sympathising landlords in Europe might confer on their labourers and mechanics, and of what emigrants to America and Australia may look forward to for themselves and their children for an indefinite number of generations.

It should always be borne in mind, that, for a cottager, the land should be always of good quality. It is of no use to put a cottager upon a common, where the produce will not pay for the labour. The experiment has frequently been tried, but has always failed; and such experiments have deterred improvement in the labouring classes. But give the Cottager land that will reward his labours; it will stimulate his industry, and ultimately tend to link each class of society in inseparable bonds for the preservation of national order and tranquillity.

GENERAL INDEX.

[Abbreviations :—*Flem. Hus.*, Flemish Husbandry. *F. R. N. Hants*, Farm Reports, North Hampshire. *F. R. Kyle*, Do., Kyle in Ayrshire. *F. R. Neth.*, Do., Netherby Farm. *F. R. Glouc.*, Do., Gloucestershire. *F. R. E. York.*, Do., East Yorkshire. *Plant.*, Useful and Ornamental Planting. *Road-m.*, Road making. *Cot. H.*, Cottage Husbandry.]

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